ICOM®

SERVICE MANUAL

VHF TRANSCEIVERS

IC-F11
IC-F11S
IC-F11BR
IC-F12
IC-F12S

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-F11/IC-F11S/IC-F11BR/IC-F12/IC-F12S** at the time of publication.

To upgrade quality, all electrical or mechanical parts and internal circuits are subject to change without notice or obligation.

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 16 V. Such a connection could cause a fire hazard and/or electric shock.

DO NOT expose the transceiver to rain, snow or any liquids.

DO NOT reverse the polarities of the power supply when connecting the transceiver.

DO NOT apply an RF signal of more than 20 dBm (100mW) to the antenna connector. This could damage the transceiver's front end.

ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<**SAMPLE ORDER**>

1130007020 S.IC	TC7S66FU	IC-F11	MAIN UNIT	1 piece
8810009510 Screw	BO M 2 x 4 NI-ZU	IC-F11	Chassis	10 pieces

Addresses are provided on the inside back cover for your convenience.



IC-F11/IC-F12



IC-F11BR/IC-F11S/
IC-F12S

REPAIR NOTES

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated turning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 40 dB to 50 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.

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SECTION 1 SPECIFICATIONS

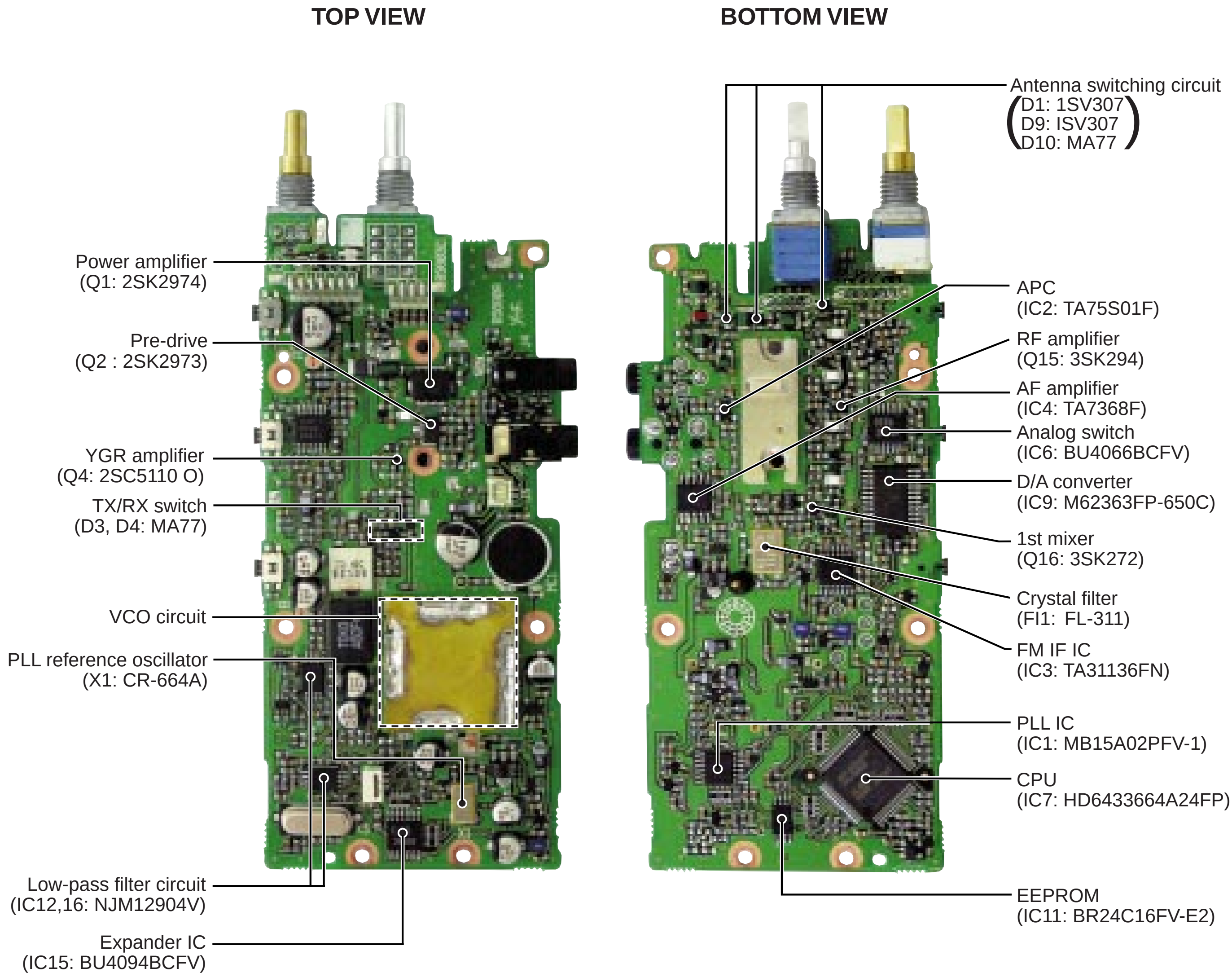
<table>
<tr><th colspan="4"></th><th>EIA-152-C/204D or TIA-603</th><th>ETS 300 086</th></tr>
<tr><td rowspan="15">GENERAL</td><td colspan="3">Frequency coverage</td><td>151.505 MHz–158.4075 MHz [F11BR] only
146.000 MHz–174.000 MHz</td><td>146.000 MHz–174.000 MHz</td></tr>
<tr><td colspan="3">Type of emission</td><td colspan="2">16K0F3E (at 25 kHz / 30 kHz), 8K50F3E (at 12.5 kHz)</td></tr>
<tr><td colspan="3">Number of channels</td><td colspan="2">2 channel (IC-F11BR / F11S / F12S), 16 channel (IC-F11 / F12)</td></tr>
<tr><td colspan="3">Power supply requirement</td><td colspan="2">7.2 V (negative ground)</td></tr>
<tr><td colspan="3">Antenna impedance</td><td colspan="2">50 Ω normal</td></tr>
<tr><td colspan="3">Input impedance (Mic)</td><td colspan="2">2.2 kΩ normal</td></tr>
<tr><td colspan="3">Output impedance (Audio)</td><td colspan="2">8 Ω normal</td></tr>
<tr><td colspan="3">Intermediate frequency</td><td colspan="2">1st: 31.050 MHz, 2nd: 450 kHz</td></tr>
<tr><td colspan="3">Operating temperature range</td><td>–30 ˚C to +60 ˚C (–22˚F to +140˚F)</td><td>–25 ˚C to +55 ˚C (–13˚F to +131˚F)</td></tr>
<tr><td rowspan="4">Current drain (at 7.2 V)</td><td rowspan="2">Tx</td><td>High power</td><td colspan="2">1.6 A (5 W) except [F11BR], 1.1 A (2 W) [F11BR] only</td></tr>
<tr><td>Low power</td><td colspan="2">0.7 A (1 W)</td></tr>
<tr><td rowspan="2">Rx</td><td>stand-by</td><td colspan="2">70 mA</td></tr>
<tr><td>Rated audio</td><td colspan="2">250 mA</td></tr>
<tr><td colspan="3">Dimensions
(Projections not included)</td><td colspan="2">54(W) × 128(H) × 37(D) mm; $2\frac{1}{8}$(W) × $5\frac{1}{25}$(H) × $1\frac{15}{32}$(D) inch</td></tr>
<tr><td colspan="3">Weight</td><td colspan="2">310 g; 10.1 oz (with BP-209), 300 g; 10.6 oz (with BP-222)</td></tr>
<tr><td rowspan="11">TRANSMITTER</td><td colspan="3">RF output power (at 7.2 V DC)</td><td colspan="2">High: 5.0 W ([F11BR]: 2.0 W), Low1: 2.0 W (except [F11BR]), low2: 1.0 W</td></tr>
<tr><td colspan="3">Modulation system</td><td colspan="2">Variable reactance frequency modulation</td></tr>
<tr><td colspan="3">Max. permissible deviation</td><td colspan="2">± 5.0 kHz (25 kHz), ± 2.5 kHz (12.5 kHz)</td></tr>
<tr><td colspan="3">External mic.connector</td><td colspan="2">3-conductor 2.5 mm ($\frac{1}{10}$ in) (2 kΩ)</td></tr>
<tr><td colspan="3">Frequency error</td><td>±5.0 ppm</td><td>±2.0 kHz (25 kHz), ± 1.5 kHz (12.5 kHz)</td></tr>
<tr><td colspan="3">Spurious emissions</td><td>73 dBc (typical)</td><td>0.25 µW @ < 1 GHz, 1.00 µW > 1 GHz</td></tr>
<tr><td colspan="3">Adjacent channel power</td><td colspan="2">70 dB*[1] (25 kHz), 60 dB*[1] (12.5 kHz)</td></tr>
<tr><td colspan="3">Audio harmonics distortion</td><td>3 % typical at 1 kHz, 40 % deviation</td><td>5 % typical at 1 kHz 60 % deviation</td></tr>
<tr><td colspan="3">FM Hum and noise</td><td>46 dB typ. (25 kHz), 40 dB typ. (12.5 kHz)</td><td>–</td></tr>
<tr><td colspan="3">Residual modulation</td><td>–</td><td>45 dB typ. (25 kHz), 43 dB typ. (12.5 kHz)</td></tr>
<tr><td colspan="3">Limiting charact of modulator</td><td colspan="2">70 % – 100 % of max. deviation</td></tr>
<tr><td rowspan="9">RECEIVER</td><td colspan="3">Receive system</td><td colspan="2">Double-conversion super heterodyne</td></tr>
<tr><td colspan="3">Intermediate frequencies</td><td colspan="2">1st: 31.050 MHz, 2nd 450 kHz</td></tr>
<tr><td colspan="3">Sensitivity</td><td>0.25 µV (typical) for 12 dB SINAD</td><td>0.25 µV (typical) for 12 dB SINAD
0.63 µV EMF (typical) for 20 dB SINAD</td></tr>
<tr><td colspan="3">Audio output power (at 7.2 V)</td><td colspan="2">0.5 W at 5 % distortion with an 8 Ω load, 0.6 W at 5 % distortion with 6 Ω load</td></tr>
<tr><td colspan="3">Adjacent channel selectivity</td><td>70 dB typ. (25 kHz), 65 dB typ. (12.5 kHz)</td><td>70 dB typ (25 kHz), 60 dB typ. (12.5 kHz)</td></tr>
<tr><td colspan="3">Spurious response</td><td colspan="2">70 dB*[1]</td></tr>
<tr><td colspan="3">Intermodulation</td><td>70 dB</td><td>65 dB</td></tr>
<tr><td colspan="3">FM Hum and noise (Typical)</td><td>46 dB*[2] (25 kHz), 40 dB*[2] (12.5 kHz)</td><td>45 dB*[3] (25 kHz), 43 dB*[3] (12.5 kHz)</td></tr>
<tr><td colspan="3">Squelch sensitivity</td><td colspan="2">0.3 µV typical at threshold</td></tr>
</table>

*[1]EIA-152-C/204D or TIA-603 is typical value, *[2]EIA-152-C/204D only, *[3]With CCITT filter

All stated specifications are subject to change without notice or obligation.

SECTION 2 INSIDE VIEWS

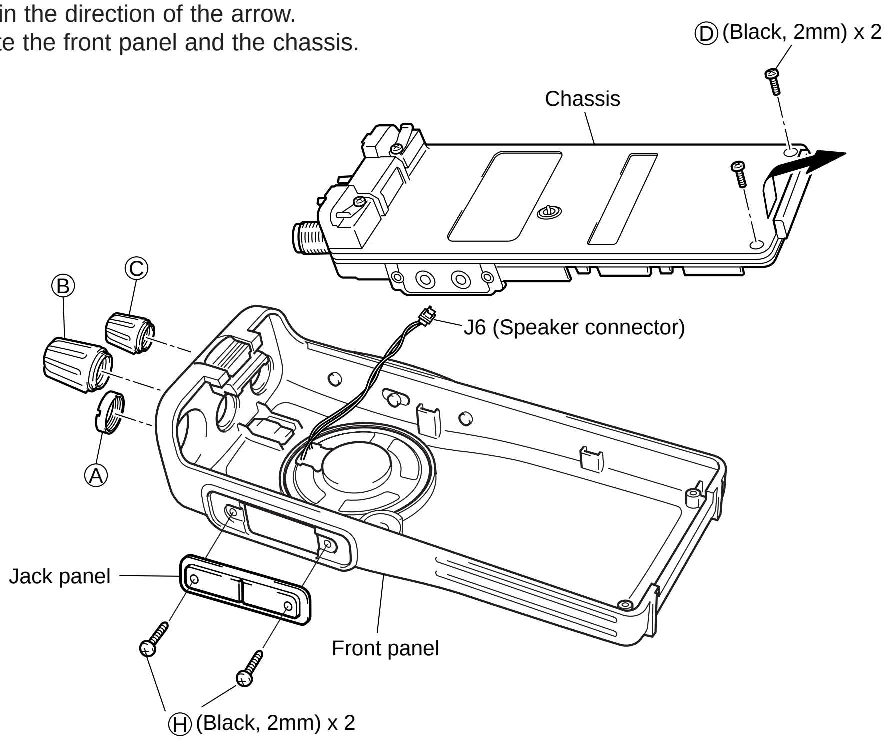
• **MAIN UNIT**



SECTION 3 DISASSEMBLY INSTRUCTIONS

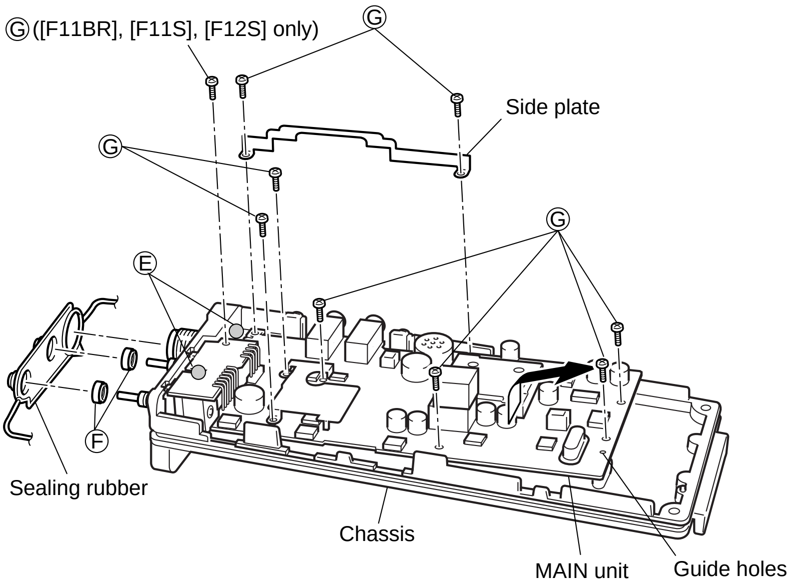
• REMOVING THE CHASSIS

① Unscrew 1 nut, Ⓐ, and remove 2 knobs, Ⓑ, Ⓒ.
② Unscrew 2 screws, Ⓓ.
③ Unscrew 2 screws, Ⓗ, to separate the Jack panel and the Front panel.
④ Take off the chassis in the direction of the arrow.
⑤ Unplug J6 to separate the front panel and the chassis.



• REMOVING THE MAIN UNIT

① Remove the searing rubber.
② Unsolder 2 points, Ⓔ, and unscrew 2 nuts, Ⓕ.
③ Unscrew 9 screws, Ⓖ, (silver, 2mm) to separate the chassis and the MAIN unit.
④ Take off the MAIN unit in the direction of the arrow.



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT

The antenna switching circuit functions as a low-pass filter while receiving. However, its impedance becomes very high while D9 and D10 are turned ON. Thus transmit signals are blocked from entering the receiver circuits. The antenna switching circuit employs a λ/4 type diode switching system.

Received signals are passed through the low-pass filter (L1, L2, C1–C5). The filtered signals are applied to the λ/4 type antenna switching circuit (D9, D10).
The passed signals are then applied to the RF amplifier circuit.

4-1-2 RF CIRCUIT

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The signals from the antenna switching circuit are amplified at the RF amplifier (Q15) after passing through the 2 stages tunable bandpass filter (D12, L21, C104, C105, D13, L54, C106, C111, C113). The amplified signals are applied to the 1st mixer circuit (Q16) after out-of-band signals are suppressed at the 2 stages tunable bandpass filter (D14, C116, C117, D15, L24, C120, C122).

Varactor diodes are employed at the bandpass filters that track the filters and are controlled by the CPU (IC7) via the D/A convertor (IC9) using T1–T4 signals. These diodes tune the centre frequency of an RF passband for wide bandwidth receiving and good image response rejection.

4-1-3 1ST MIXER AND 1ST IF CIRCUITS

The 1st mixer circuit converts the received signal into a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency will pass through a crystal filter at the next stage of the 1st mixer.

The signals from the RF circuit are mixed at the 1st mixer (Q16) with a 1st LO signal (114.95–142.95 MHz) coming from the VCO circuit to produce a 31.05 MHz 1st IF signal.

The 1st IF signal is applied to a crystal filter (FI1) to suppress out-of-band signals. The filtered 1st IF signal is applied to the IF amplifier (Q17), then applied to the 2nd mixer circuit (IC3, pin 16).

4-1-4 2ND IF AND DEMODULATOR CIRCUITS

The 2nd mixer circuit converts the 1st IF signal into a 2nd IF signal. A double conversion superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from the IF amplifier is applied to the 2nd mixer section of the FM IF IC (IC3, pin 16), and is mixed with the 2nd LO signal to be converted into a 450 kHz 2nd IF signal.

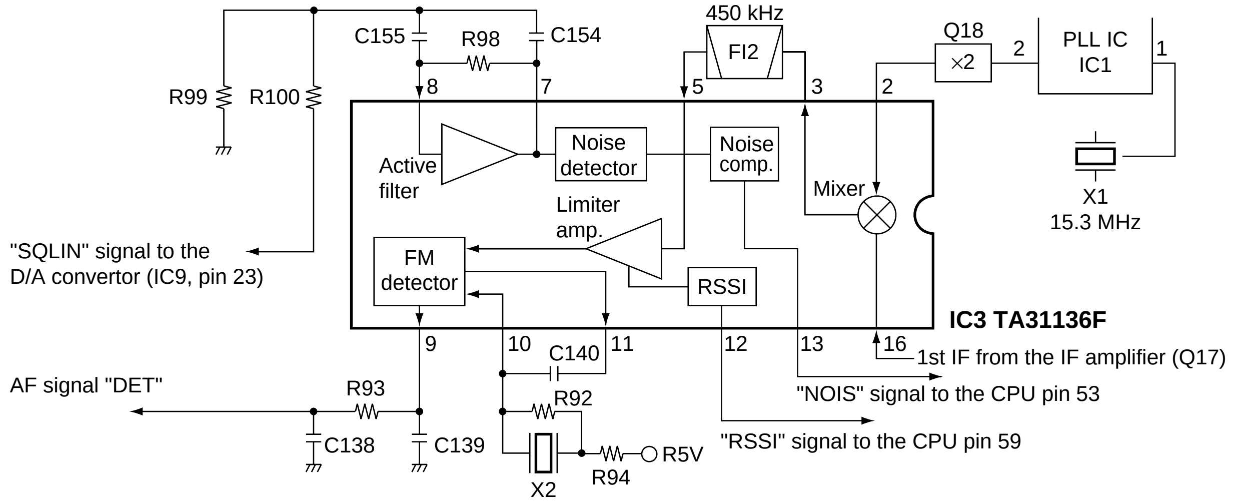
The FM IF IC contains the 2nd mixer, limiter amplifier, quadrature detector and active filter circuits. A 2nd LO signal (30.6 MHz) is produced at the PLL circuit by tripling it's reference frequency.

The 2nd IF signal from the 2nd mixer (IC3, pin 3) passes through a ceramic filter (FI2) to remove unwanted heterodyned frequencies. It is then amplified at the limiter amplifier (IC3, pin 5) and applied to the quadrature detector (IC3, pins 10, 11) to demodulate the 2nd IF signal into AF signals.

4-1-5 AF CIRCUIT

AF signals from the FM IF IC (IC3, pin 9) are applied to the analog switch (IC6, pin 1) after being passed through the high-pass filter (IC5B, pins 5, 7) via the "DET" signal. The signals pass through the low-pass filter (IC5D, pins 13, 14), and then applied to the analog switch (IC6, pins 9, 10) again. The output signals from the analog swtich (IC6, pin 11) are applied to the AF power amplifier (IC4, pin 4) after being passed through the [VOL] control (SW-A/SW-B unit; R143) via the "VOLIN" and "VOLOUT" signals.

• 2ND IF AND DEMODULATOR CIRCUITS



The applied AF signals are amplified at the AF power amplifier circuit (IC4, pin 4) to obtain the specified audio level. The amplified AF signals output from pin 10 as "AFOUT"signal are applied to the internal speaker (SP1) as the "SP" signal via the [SP] jack when no plug is connected to the jack.

4-1-6 SQUELCH CIRCUIT

A squelch circuit cuts out AF signals when no RF signals are received. By detecting noise components in the AF signals, the squelch switches the AF mute switch.

A portion of the AF signals from the FM IF IC (IC3, pin 9) as "DET" signal are applied to the D/A convertor IC (IC9, pin 24). The signals from the D/A convertor (IC9, pin 23) as "SQLIN" signals are applied to the active filter section (IC3, pin 8) where noise components are amplified and detected with an internal noise detector.

The active filter section amplifies noise components. The filtered signals are rectified at the noise detector section and converted into "NOIS" (pulse type) signals at the noise comparator section. The "NOIS" signal output from IC3, pin 13, and is applied to the CPU (IC7, pin 53).

The CPU detects the receiving signal strength from the number of the pulses, and outputs "EXST", "SO", "SCK" signals. The signals are applied to the expander IC (IC15, pins 1, 2, 3), and then outputs "RMUT" signal from pin 4. This signal controls the analog switch (IC6, pin 13) to cut the AF signal line.

4-2 TRANSMITTER CIRCUITS

4-2-1 MICROPHONE AMPLIFIER CIRCUIT

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis characteristics from the microphone to a level needed for the modulation circuit.

The AF signals from the microphone are applied to the microphone amplifier circuit (IC5c, pin 10) after being pass through the high-pass filter (C186, C187). The amplified AF signals are passed through the low-pass filter circuit (IC5d, pins 13, 14) via the mute switch (IC6, pins 2, 3, 4). The filtered AF signals are applied to the modulator circuit after being passed through the mute switch (IC6, pins 8, 9, 10).

4-2-2 MODULATION CIRCUIT

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signal.

The audio signals change the reactance of a diode (D6) to modulate an oscillated signal at the VCO circuit (Q10, Q11). The oscillated signal is amplified at the buffer-amplifiers (Q5, Q7), then applied to the T/R switching circuit (D3, D4).

4-2-3 DRIVE/POWER AMPLIFIER CIRCUITS

The signal from the VCO circuit passes through the T/R switching circuit (D3) and is amplified at the YGR (Q4), pre-drive (Q2) and power amplifier (Q1) to obtain 5 W ([F11BR] is 2 W) of RF power (at 7.2 V DC). The amplified signal passes through the antenna switching circuit (D1) via the power detector (D2), and low-pass filter and is then applied to the antenna connector.

The bias current of the YGR amplifier (Q4), pre-drive (Q2) and the power amplifier (Q1) is controlled by the APC circuit.

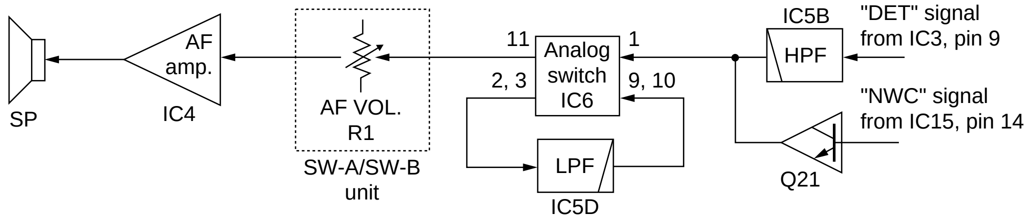
4-2-5 APC CIRCUIT

The APC circuit (IC2) protects the drive and the power amplifiers from excessive current drive, and selects HIGH or LOW output power.

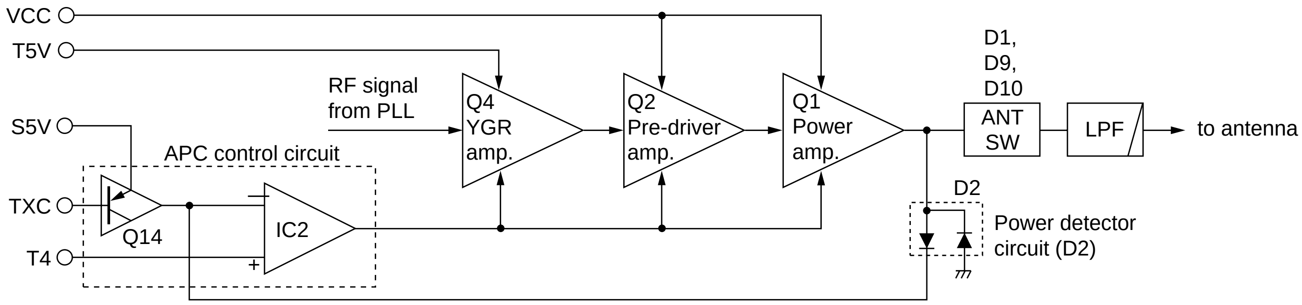
The signal output from the power detector circuit (D2) is applied to the differential amplifier (IC2, pin 3), and the "T4" signal from the expander (IC9, pin 11), controlled by the CPU (IC7), is applied to the other input for reference.

When the driving current is increased, input voltage of the differential amplifier (pin 3) will be increased. In such cases, the differential amplifier output voltage (pin 4) is decreased to reduce the driving current.

• AF CIRCUIT



• APC CIRCUIT



4-3 PLL CIRCUIT

4-3-1 GENERAL

A PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL output compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by a crystal oscillator and the divided ratio (N-data) of a programmable divider.

The PLL circuit, using a one chip PLL IC (IC1), directly generates the transmit frequency and divided ratio based on serial data from the CPU and compares the phases of VCO signals with the reference oscillator frequency. The PLL IC detects the out-of-step phase and output from pin 5. The reference frequency (15.3 MHz) is oscillated by X1.

4-3-2 TX LOOP

The generated signal at the VCO (Q10, Q11, D5, D7) enters the PLL IC (IC1, pin 8) and is divided at the programmable divider section and is then applied to the phase detector section.

The phase detector compares the input signal with a reference frequency, and then outputs the out-of-phase signal (pulse-type signal) from pin 5.

The pulse-type signal is converted into DC voltage (lock voltage) at the loop filter (R40–R42, C75, C76), and then applied to varactor diodes (D5, D7) of the VCO to stabilize the oscillated frequency.

4-3-3 RX LOOP

The generated signal at the VCO (Q10, Q11, D5, D7) enters the PLL IC (IC1, pin 8) and is divided at the programmable divider section and is then applied to the phase detector section.

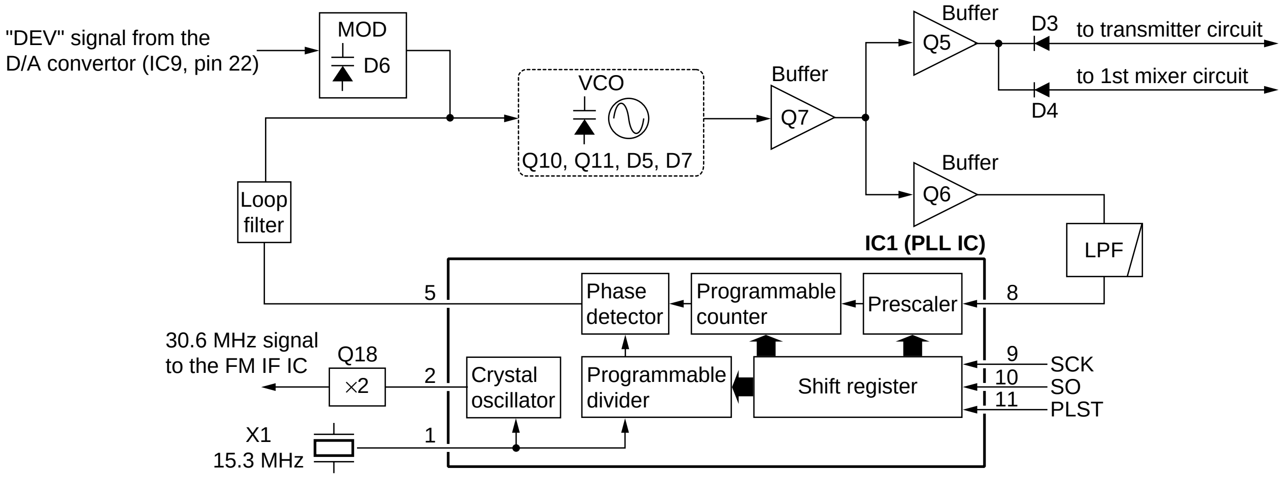
The phase detector compares the input signal with a reference frequency, and then outputs the out-of-phase signal (pulse-type signal) from pin 5.

The pulse-type signal is converted into DC voltage (lock voltage) at the loop filter (R40–R42, C75, C76), and then applied to varactor diode (D5) of the VCO to stabilize the oscillated frequency. The lock voltage is also used for the receiver circuit for the bandpass filter center frequency. The lock voltage from the loop filter is amplified at the buffer amplifier (Q13) and then applied to the CPU (IC7, pin 60). The signal is analyzed at the CPU, and then applied to the D/A convertor (IC9). The D/A convertor outputs “T1”, “T2”, “T3”, “T4” signals to RF bandpass filters D12–D15 to suppress harmonic components.

4-3-4 VCO CIRCUIT

The VCO outputs from Q11 and Q10 are buffer amplified at Q7 and Q5, and are then sent to the T/R switch (D3, D4). The receive LO signal is applied to the 1st mixer circuit (Q16) through an attenuator, and the tramsmit signal is applied to the YGR amplifier (Q4). A portion of the VCO output is reapplied to the PLL IC (IC1, pin 8) via the buffer amplifier (Q6) and low-pass filter (L18, R53, C89–C91).

• PLL CIRCUIT



4-4 POWER SUPPLY CIRCUITS

VOLTAGE LINE

LINE	DESCRIPTION
HV	The voltage from the attached battery pack.
VCC	The same voltage as the HV line (battery voltage) which is controlled by the power swtich ([VOL] control).
CPU5V	Common 5 V converted from the VCC line by the +5 regulator circuit (IC10). The output voltage is applied to the CPU (IC7), reset circuit (IC8) and etc.
T5V	5 V for transmitter circuits regulated by the T5 regulator circuit (Q27).
R5V	5 V for receiver circuits regulated by the R5 regulator circuit (Q26).
S5V	Common 5 V converted from the VCC line by the S5 regulator circuit (Q24, Q19).
+5V	The same voltage as the CPU5V line for the analog swtich (IC6), buffer amplifier (Q13), etc.
VCO5V	The same voltage as the +5V line for the VCO (Q10, Q11) and buffer amplifiers (Q5–Q7).

4-5 PORT ALLOCATIONS

4-5-1 CPU (IC7)

Pin number	Port name	Description
7	RES	Input port for RESET signal.
13 14 19 20	SENC0 SENC1 SENC2 SENC3	Outputs single tone encode signal.
23 24 25	CENC0 CENC1 CENC2	Outputs CTCSS/DTCS data signal.
28	SCK	Outputs serial clock signal to the PLL IC (IC1), EEPROM (IC11), etc.
29	SO	Outputs data signal to the PLL IC (IC1) and D/A convertor (IC9).
30	BEEP	Outputs beep audio signal.
36	PLST	I/O port for strobe signal from/to PLL IC (IC9).
37	DAST	• Outputs strobe signal to the D/A convertor (IC9). • Input port for the initial version signal.
38	EXST	Outputs strobe signal for the expander IC (IC15).
39	PTT	Input port for [PTT] swtich signal. High: While [PTT] switch is pushed.
40	TXC	Outputs TX mute control signal. High: While transmitting
41	RLED	Outputs BUSY LED control signal. High: While receiving.
42	TLED	Outputs TX LED control signal. high: While transmitting.
43	AFON	Outputs control signal for the regulator circuit of AF power amplifier. High: While squelch is open, etc.
44	ESDA	I/O port for data signal from/to the EEPROM (IC11).
45	CLI	Input port for cloning signal.
46	CLO	Outputs the cloning signal.
51 52	F1 F2	Input ports for the customization key signals.
53	NOIS	Input port for the noise pulse signal for the squelch function.
54	UNLK	Input port for PLL unlock signal. High: PLL is locked.
55	TEMP	Input port for the transceiver's internal tempereture detection.
57	CDEC	Input port for CTCSS/DTCS signals.
58	SDEC	Input port for single tone decode signal.
59	RSSI	Input port for the RSSI voltage.
60	LVIN	Input port for the PLL lock voltage.

CPU (IC7)–continued

Pin number	Port name	Description
61	BDET	Input port for the battery's type detection.
62	BATV	Input port for battely voltage detection.

4-5-2 OUTPUT EXPANDER IC (IC15)

Pin number	Port name	Description
4	CSFT	Outputs clock shift control signal for CPU.
5	RMUT	Outputs RX mute control signal.
6	MMUT	Outputs TX mute control signal.
7	DUSE	Outputs low-pass filter cut-off frequency control signal when DTCS is activated.
11	T5C	Outputs T5 regulator control signal. Low: While transmitting.
12	R5C	Outputs R5 regulator control signal. Low: While receiving.
13	S5C	Outputs S5 regulator control signal. Low: While power is ON.
14	NWC	Outputs Narrow/Wide of channel spacing control signal. Low: While Narrow is selected.

4-5-3 D/A CONVERTOR IC (IC9)

Pin number	Port name	Description
2, 3, 10, 11	T1–T4	Output tunable bandpass filters control signals.
14	REF	Outputs differential voltage for the reference oscillator (Q31, D19, X1).
15	BAL	Outputs DTCS balance control signal.
22	DEV	Outputs modulating signal for the modulator circuit (D6).

SECTION 5 ADJUSTMENT PROCEDURES

5-1 PREPARATION

When you adjust the contents on page 5-5 or 5-6, SOFTWARE ADJUSTMENT, the optional CS-F11 ADJ ADJUSTMENT SOFTWARE (Rev. 1.0 or later), OPC-478 CLONING CABLE and a JIG CABLE (see illustration at page 5-2) are required.

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 7.2 V DC Current capacity : 5 A or more	Audio generator	Frequency range : 300–3000 Hz Output level : 1–500 mV
RF power meter (terminated type)	Measuring range : 1–10 W Frequency range : 300–600 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Attenuator	Power attenuation : 40 or 50 dB Capacity : 10 W or more
Frequency counter	Frequency range : 0.1–600 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Standard signal generator (SSG)	Frequency range : 120–600 MHz Output level : 0.1 µV–32 mV (–127 to –17 dBm)
		DC voltmeter	Input impedance : 50 kΩ/V DC or better
FM deviation meter	Frequency range : DC–600 MHz Measuring range : 0 to ±5 kHz	Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V
Digital multimeter	Input impedance : 10 MΩ/V DC or better	AC millivoltmeter	Measuring range : 10 mV–10 V

■ SYSTEM REQUIREMENTS

- IBM PC compatible computer with an RS -232C serial port (38400 bps or faster)
- Microsoft Windows 95 or Windows 98
- Intel i486DX processor or faster (Pentium 100 MHz or faster recommended)
- At least 16 MB RAM and 10 MB of hard disk space
- 640×480 pixel display (800×600 pixel display recommended)

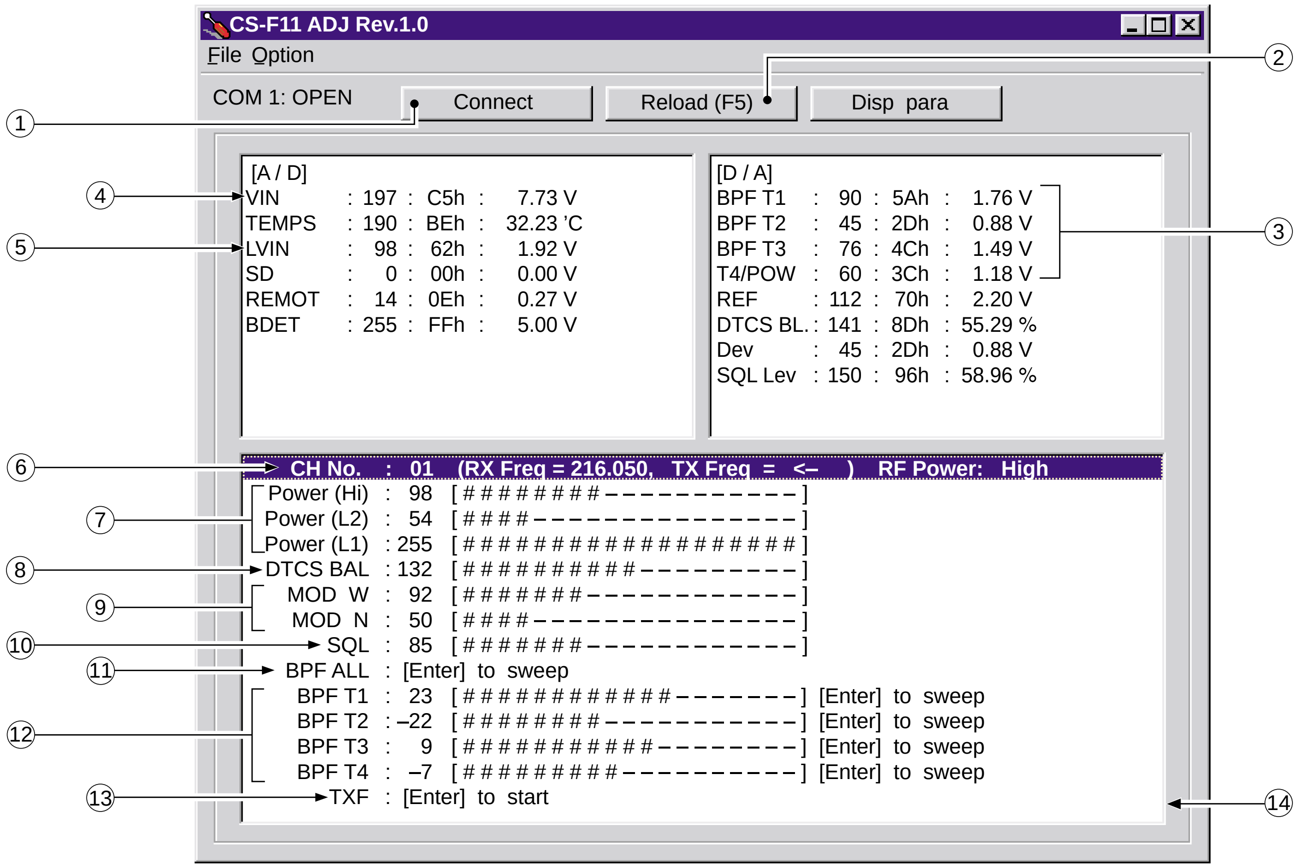
■ ADJUSTMENT SOFTWARE INSTALLATION

① Boot up Windows.
 - Quit all applications when Windows is running.
② Insert the cloning software CD-ROM into the appropriate CD-ROM drive.
③ Select ‘Run’ from the [Start] menu.
④ Type the setup program name using the full path name, then push the [Enter] key. (For example; D:\ setup)
⑤ Follow the prompts.
⑥ Program group ‘CS-F11’ appears in the ‘Programs’ folder of the [Start] menu.

■ STARTING SOFTWARE ADJUSTMENT

① Connect transceiver and PC with the optional OPC-478 and the JIG cable.
② Boot up Windows, and turn the transceiver power ON.
③ Click the program group ‘CS-F11 ADJ’ in the ‘Programs’ folder of the [Start] menu, then CS-F11 ADJ’s window is appeared.
④ Click ‘Connect’ on the CS-F11’s window, then appears transceiver’s up-to-date condition.
⑤ Set or modify adjustment data as desired.

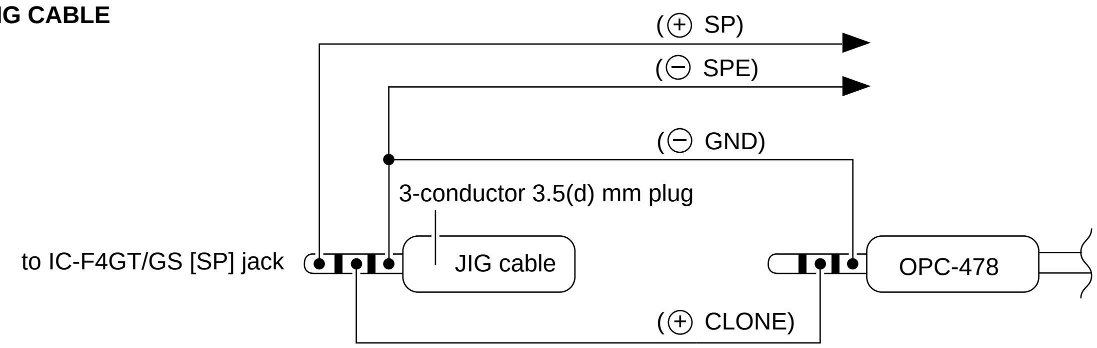
• **SCREEN DISPLAY EXAMPLE**



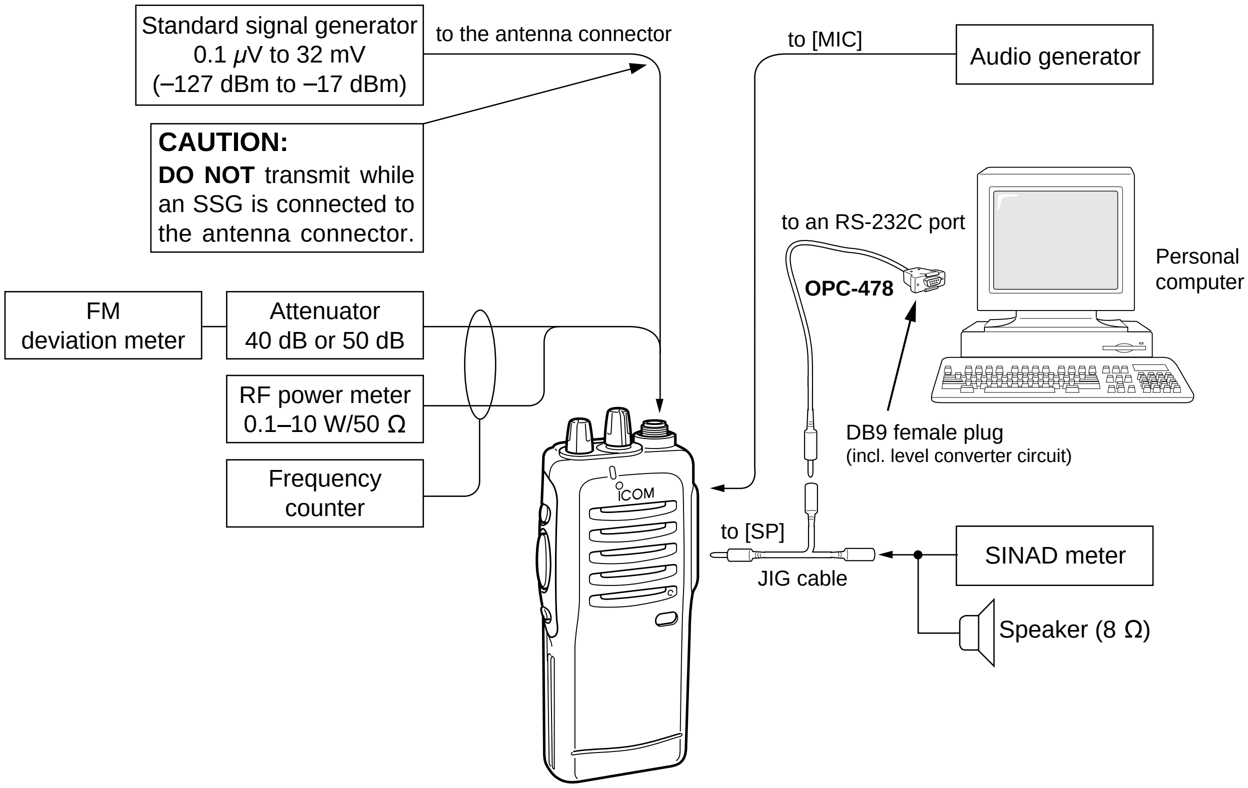
NOTE: The above values for settings are example only.
Each transceiver has its own specific values for each setting.

① : Transceiver's connection state	⑧ : DTCS wave balance
② : Reload adjustment data	⑨ : FM deviation
③ : Receive sensitivity measurement	⑩ : Squelch level
④ : Connected DC voltage	⑪ : Receive sensitivity (automatically)
⑤ : PLL lock voltage	⑫ : Receive sensitivity (manually)
⑥ : Operating channel select	⑬ : Reference frequency
⑦ : RF output power	⑭ : Adjustment items

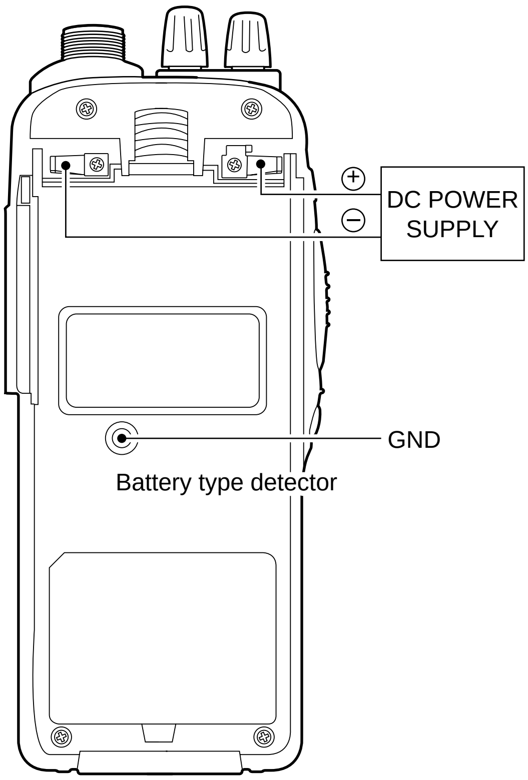
• **JIG CABLE**



· **CONNECTION**



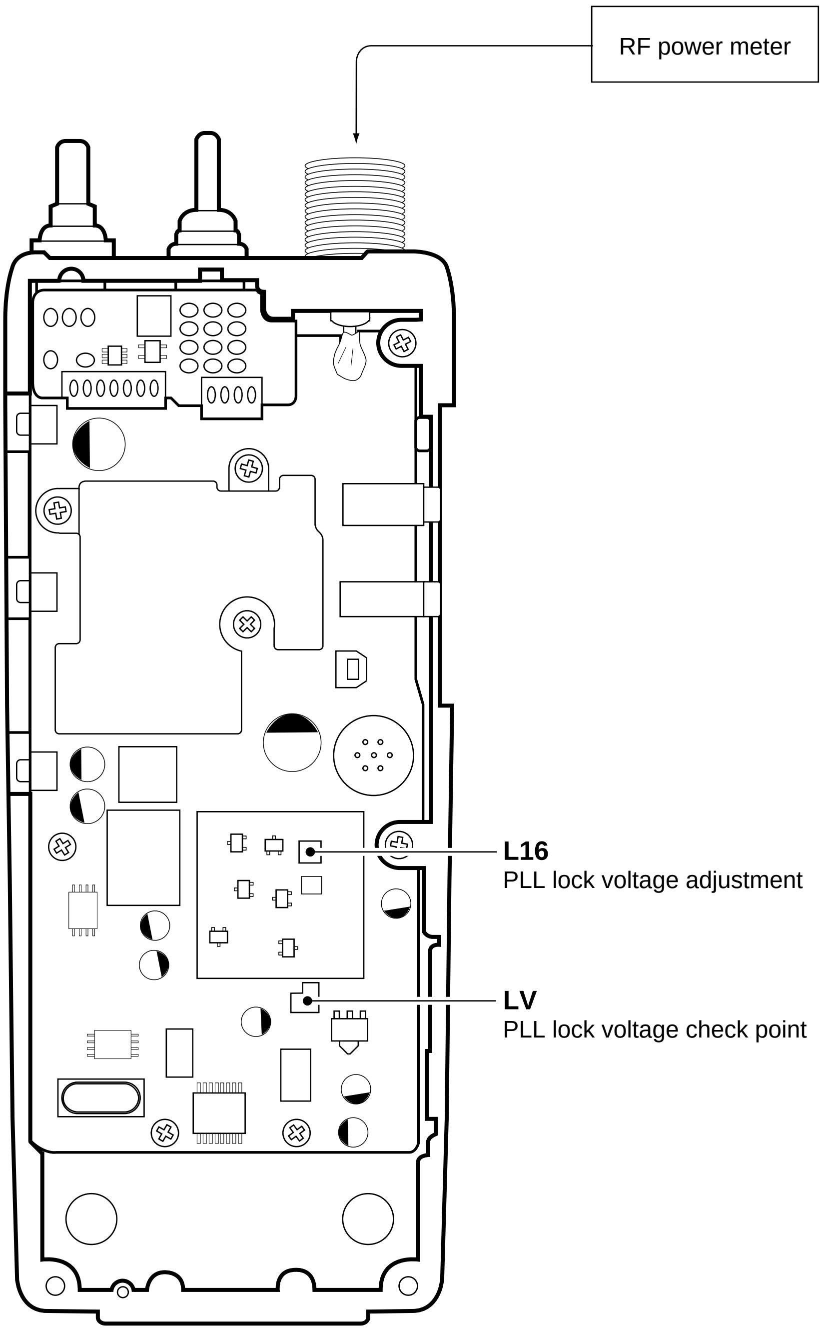
· **DC POWER CABLE CONNECTIONS**



NOTE: When you adjust the output power (high power), the battery type detector must be connected to GND (see illustration at above). Ohterwise the transceiver does not transmit high power, the output power will be low.

5-2 PLL ADJUSTMENT

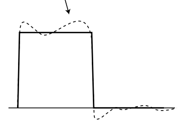
ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT	
			UNIT	LOCATION		UNIT	ADJUST
PLL LOCK VOLTAGE	1	• Operating frequency: 174.000 MHz • Transmitting	MAIN	Connect a digital multi meter to check point LV.	4.0 V	MAIN	L16
	2	• Operating frequency: 146.000 MHz • Receiving			0.8–1.8 V		Verify
	3	• Transmitting			0.8–1.8 V		



TOP VIEW

5-3 SOFTWARE ADJUSTMENT

Select an operation using [↑] / [↓] keys, then set specified value using [←] / [→] keys on the connected computer keyboard.

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE
			UNIT	LOCATION	
REFERENCE FREQUENCY [TXF]	1	• Operating frequency: 174.000 MHz*[1] 158.4075 MHz*[2] • High/Low switch : Low • Connect the RF power meter or 50 Ω dummy load to the antenna connector. • Transmitting	Top panel	Loosely couple a frequnecy counter to the antenna connector.	174.0000 MHz*[1] 158.4075 MHz*[2]
OUTPUT POWER [POWER(Hi)]	1	• Operating frequency: 146.000 MHz*[1] 151.505 MHz*[2] • High/Low switch : High • Transmitting	Top panel	Connect an RF power meter to the antenna connector.	5.0 W*[1] 2.0 W*[2]
[POWER(L2)]	2	• High/Low switch : Low2 • Transmitting			2.0 W
[POWER(L1)]	3	• High/Low switch : Low1 • Transmitting			1.0 W
FM DEVIATION (Wide) [MOD W]	1	• Operating frequency: 146.000 MHz*[1] 151.505 MHz*[2] • High/Low switch : Low1 • Channel spacing : Wide • Connect the audio generator to the [MIC] jack and set as: 1.0 kHz/150 mVrms • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis : OFF Detector : (P–P)/2 • Transmitting	Top panel	Connect an FM deviation meter to the antenna connector through the attenuator.	Between ±4.05 kHz and ±4.15 kHz
(Narrow) [MOD N]	2	• Channel spacing : Narrow • Transmitting			Between ±2.05 kHz and ±2.15 kHz
DTCS WAVE FORM [DTCS BAL]	1	• Operating frequency: 174.000 MHz*[1] 158.4075 MHz*[2] • High/Low switch : Low1 • No audio applied to the [MIC] jack. • DTCS code : 007 • Transmitting	Top panel	Connect an FM deviation meter with an oscilloscope to the antenna connector through an attenuator.	Set to flat wave form 

*[1]IC-F11, F11S, F12 and F12S. *[2]IC-F11BR only.

SOFTWARE ADJUSTMENT – continued

Select an operation using [↑] / [↓] keys, then set specified value using [←] / [→] keys on the connected computer keyboard.

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT UNIT	MEASUREMENT LOCATION	VALUE
RX SENSITIVITY [BPF T1]–[BPF T4]	1	• Operating frequency: 146.000 MHz*[1] 151.505 MHz*[2] • Channel spacing :Narrow • Connect a standard signal generator to the antenna connector and set as: Frequency : 146.000 MHz*[1] 151.505 MHz*[2] Level : 10 μV* (–87 dBm) Modulation : OFF Deviation : ±1.75 kHz • Receiving	Top panel	Connect a SINAD meter with an 8 Ω load to the [SP] jack.	Minimum distortion level
		CONVENIENT: The BPF T1–BPF T4 can be adjusted automatically. ①-1: Set the cursol to “BPF ALL” on the adjustment program and then push [ENTER] key. ①-2: The connected PC tunes BPF T1–BPF T4 to peak levels. or ②-1: Set the cursol to one of BPF T1, T2, T3, or T4 as desired. ②-2: Push [ENTER] key to start tuning. ②-3: Repeat ②-1 and ②-2 to perform additional BPF tuning.			
SQUELCH LEVEL [SQL]	1	• Operating frequency: 160.000 MHz*[1] 156.956 MHz*[2] • Channel spacing : Wide • Connect a standard signal generator to the antenna connector and set as: Frequency : 160.000 MHz*[1] 156.956 MHz*[2] Level : 0.2 μV* (–121 dBm) Modulation : 1 kHz Deviation : ±3.5 kHz • Receiving	Top panel	Connect a SINAD meter with an 8Ω load to the [SP] jack.	12 dB SINAD
	2	• Receiving			At the point where the audio signals just appears.

*The output level of the standard signal generator (SSG) is indicated as the SSG’s open circuit.
*[1]IC-F11, F11S, F12 and F12S. *[2]IC-F11BR only.

SECTION 6 PARTS LIST

[SW-A UNIT] ([F11] AND [F12] ONLY)

REF NO.	ORDER NO.	DESCRIPTION	
Q1	1590003020	S.TRANSISTOR	XP4216-(TX)
R1	7210003060	VARIABLE	TP76N00N-15F-10KA-2251
R2	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R3	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)
F1	5210000710	S.FUSE	KAB 2402 322 NA29
DS1	5040002070	S.LED	LNJ107W5PRW
S1	2250000450	ENCODER	TP70QF4161-16F-2458A
EP1	0910054463	PCB	B 5603C

[SW-B UNIT] ([F11BR], [F11S] AND [F12S] ONLY)

REF NO.	ORDER NO.	DESCRIPTION	
Q1	1590003020	S.TRANSISTOR	XP4216-(TX)
R1	7210003060	VARIABLE	TP76N00N-15F-10KA-2251
R2	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R3	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)
F1	5210000710	S.FUSE	KAB 2402 322 NA29
DS1	5040002070	S.LED	LNJ107W5PRW
W1	7120000470	JUMPER	ERDS2T0
W2	7120000470	JUMPER	ERDS2T0
EP1	0910054473	PCB	B 5604C

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
IC1	1140005990	S.IC	MB15A02PFV1-G-BND-ER
IC2	1110002750	S.IC	TA75S01F (TE85R)
IC3	1110003490	S.IC	TA31136FN (D,EL)
IC4	1110001810	S.IC	TA7368F (TP1)
IC5	1110005320	S.IC	NJM13403V-TE1
IC6	1130008090	S.IC	BU4066BCFV-E1
IC7	1140009850	S.IC	HD6433664A24FP
IC8	1130009110	S.IC	S-80942ANMP-DD6-T2
IC9	1190000350	S.IC	M62363FP-650C
IC10	1110005350	S.IC	NJM2870F05-TE1
IC11	1130010490	S.IC	BR24C16FV-E2
IC12	1110005330	S.IC	NJM12904V-TE1
IC13	1130007020	S.IC	TC7S66FU (TE85R)
IC15	1130007570	S.IC	BU4094BCFV-E2
IC16	1110005330	S.IC	NJM12904V-TE1

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
Q1	1560001050	S.FET	2SK2974	
Q2	1560001020	S.FET	2SK2973 (MTS101P)	
Q4	1530003420	S.TRANSISTOR	2SC5110-O (TE85R)	
Q5	1530003310	S.TRANSISTOR	2SC5107-O (TE85R)	
Q6	1530003310	S.TRANSISTOR	2SC5107-O (TE85R)	
Q7	1530003310	S.TRANSISTOR	2SC5107-O (TE85R)	
Q8	1590000430	S.TRANSISTOR	DTC144EUA T106	
Q10	1530003230	S.TRANSISTOR	2SC5085-Y (TE85R)	
Q11	1530003230	S.TRANSISTOR	2SC5085-Y (TE85R)	
Q12	1590001190	S.TRANSISTOR	XP6501-(TX) .AB	
Q13	1560000540	S.FET	2SK880-Y (TE85R)	
Q14	1590000720	S.TRANSISTOR	DTA144EUA T106	
Q15	1580000750	S.FET	3SK294 (TE85L)	
Q16	1580000660	S.FET	3SK272-(TX)	
Q17	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	
Q18	1530002690	S.TRANSISTOR	2SC4116-GR (TE85R)	
Q19	1520000460	S.TRANSISTOR	2SB1132 T100 R	
Q20	1590001190	S.TRANSISTOR	XP6501-(TX) .AB	
Q21	1590000430	S.TRANSISTOR	DTC144EUA T106	
Q22	1590002530	S.TRANSISTOR	UN911H (TX)	
Q23	1590000720	S.TRANSISTOR	DTA144EUA T106	
Q24	1520000460	S.TRANSISTOR	2SB1132 T100 R	
Q25	1590001190	S.TRANSISTOR	XP6501-(TX) .AB	
Q26	1510000920	S.TRANSISTOR	2SA1577 T107 Q	
Q27	1510000920	S.TRANSISTOR	2SA1577 T107 Q	
Q28	1590000430	S.TRANSISTOR	DTC144EUA T106	
Q29	1530002690	S.TRANSISTOR	2SC4116-GR (TE85R)	
Q30	1590001770	S.TRANSISTOR	XP1213 (TX)	
Q31	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)	
Q32	1590000660	S.TRANSISTOR	DTC144TU T107	
Q33	1560000840	S.FET	2SK1829 (TE85R)	Ⓐ only
Q35	1590000430	S.TRANSISTOR	DTC144EUA T106	
Q36	1560000840	S.FET	2SK1829 (TE85R)	
D1	1750000580	S.DIODE	1SV307 (TPH3)	
D2	1790001670	S.DIODE	RB706F-40T106	
D3	1790000620	S.DIODE	MA77 (TX)	
D4	1790000620	S.DIODE	MA77 (TX)	
D5	1720000780	S.VARICAP	HVU350B TRF	
D6	1790001260	S.DIODE	MA2S077-(TX)	
D7	1720000780	S.VARICAP	HVU350B TRF	
D9	1750000580	S.DIODE	1SV307 (TPH3)	
D10	1790000620	S.DIODE	MA77 (TX)	
D12	1720000780	S.VARICAP	HVU350B TRF	
D13	1720000780	S.VARICAP	HVU350B TRF	
D14	1720000780	S.VARICAP	HVU350B TRF	
D15	1720000780	S.VARICAP	HVU350B TRF	
D16	1790000620	S.DIODE	MA77 (TX)	
D17	1790001670	S.DIODE	RB706F-40T106	
D18	1790001250	S.DIODE	MA2S111-(TX)	Ⓐ only
D19	1750000830	S.VARICAP	HVC362TRF	
D20	1790001250	S.DIODE	MA2S111-(TX)	
D21	1790001250	S.DIODE	MA2S111-(TX)	
D22	1790000620	S.DIODE	MA77 (TX)	
D23	1790001250	S.DIODE	MA2S111-(TX)	
D24	1720000360	S.DIODE	HSU88TRF	
D25	1790001250	S.DIODE	MA2S111-(TX)	
FI1	2030000130	S.XTAL	FL-333 (31.05 MHz)	
FI2	2020001840	CERAMIC	ALFYM450F=K	
X1	6050011070	S.XTAL	CR-664A (15.300 MHz)	
X2	6070000210	S.DISCRIMINATOR	CDBCA450CX24	
X3	6050011180	S.XTAL	CR-702 (14.7456 MHz)	
L1	6200008580	S.COIL	0.30-1.4-6TL 32N	
L2	6200009800	S.COIL	0.26-1.1-7TR 30N	
L3	6200002860	S.COIL	NL 252018T-4R7J	
L4	6200008280	S.COIL	0.30-1.7-7TL 50N	
L5	6200008230	S.COIL	0.30-1.3-5TL 22N	
L6	6200003590	S.COIL	EXCCL3225U1	

Ⓐ: [F12] and [F12S] Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11]and [F12] Ⓓ: [F11BR], [F11S] and [F12S]

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
L9	6200005710	S.COIL	ELJRE 27NG-F
L10	6200006980	S.COIL	ELJRE R10G-F
L11	6200006980	S.COIL	ELJRE R10G-F
L15	6200004920	S.COIL	MLF1608A 2R2K-T
L16	6200008190	S.COIL	0.25-1.9-8TL 80N
L17	6200002860	S.COIL	NL 252018T-4R7J
L18	6200005720	S.COIL	ELJRE 33NG-F
L19	6200008280	S.COIL	0.30-1.7-7TL 50N
L20	6200008280	S.COIL	0.30-1.7-7TL 50N
L21	6200007750	S.COIL	LQN21A 56NJ04
L22	6200007750	S.COIL	LQN21A 56NJ04
L24	6200007750	S.COIL	LQN21A 56NJ04
L25	6200009180	S.COIL	ELJRE R10J-F3
L26	6200005540	S.COIL	ELJNC R47K-F
L27	6200001980	S.COIL	NL 252018T-1R0J
L28	6200001980	S.COIL	NL 252018T-1R0J
L29	6200009210	S.COIL	NL 252018T-390J
L50	6200009180	S.COIL	ELJRE R10J-F3
L51	6200007690	S.COIL	LQN21A 18NJ04
L52	6200008260	S.COIL	0.30-1.7-8TL 60N
L53	6200008510	S.COIL	0.30-0.9-4TR 10.5N
L54	6200007750	S.COIL	LQN21A 56NJ04
L56	6200002690	S.COIL	MLF1608A 1R0M-T
R1	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R2	7030003340	S.RESISTOR	ERJ3GEYJ 151 V (150 Ω)
R3	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R4	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R5	7030003240	S.RESISTOR	ERJ3GEYJ 220 V (22 Ω)
R6	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R7	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R8	7030003300	S.RESISTOR	ERJ3GEYJ 680 V (68 Ω)
R9	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R10	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R13	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R16	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R17	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R18	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R19	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R20	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R21	7030004040	S.RESISTOR	ERJ3GEYJ 4R7 V (4.7 Ω)
R22	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R23	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R24	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R26	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R27	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R28	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R29	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)
R31	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R32	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R34	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R35	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R36	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R37	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R38	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R39	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R40	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R41	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R42	7030004050	S.RESISTOR	ERJ3GEYJ 1R0 V (1 Ω)
R43	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R44	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R45	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R46	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R47	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R48	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R49	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R50	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R51	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R52	7410000950	S.ARRAY	EXB-V8V 102JV
R53	7030003290	S.RESISTOR	ERJ3GEYJ 560 V (56 Ω)
R54	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R55	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R56	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R57	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R58	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R59	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)
R60	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R61	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R62	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R63	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)

Ⓐ: [F12] and [F12S]　　Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11]and [F12]　　Ⓓ: [F11BR], [F11S] and [F12S]

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
R64	7030003590	S.RESISTOR	ERJ3GEYJ 183 V (18 kΩ)	Ⓐ
	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	Ⓑ
R65	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	Ⓐ
	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)	Ⓑ
R66	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R68	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R70	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R71	7030005050	S.RESISTOR	ERJ2GEJ 103 X (10 kΩ)	
R72	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R73	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R74	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R75	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R76	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)	
R77	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R78	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R79	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R80	7030003210	S.RESISTOR	ERJ3GEYJ 120 V (12 Ω)	
R81	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R83	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	
R85	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)	
R86	7030003330	S.RESISTOR	ERJ3GEYJ 121 V (120 Ω)	
R88	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)	
R89	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R90	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	
R91	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)	
R92	7030003470	S.RESISTOR	ERJ3GEYJ 182 V (1.8 kΩ)	
R93	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)	
R94	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)	
R95	7030003340	S.RESISTOR	ERJ3GEYJ 151 V (150 Ω)	
R96	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)	
R97	7030003780	S.RESISTOR	ERJ3GEYJ 684 V (680 kΩ)	
R98	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R99	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)	
R100	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R102	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	
R103	7030003260	S.RESISTOR	ERJ3GEYJ 330 V (33 Ω)	
R104	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R105	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)	
R106	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)	
R107	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R109	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R110	7030004910	S.RESISTOR	ERJ3GEYF 332 V (3.3 kΩ)	
R111	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)	
R112	7030004730	S.RESISTOR	ERJ3GEYF 222 V (2.2 kΩ)	
R113	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)	
R114	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R115	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	
R116	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)	
R117	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R118	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R119	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)	
R120	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)	
R121	7030010320	S.RESISTOR	ERJ3GEYF 153 V (15 kΩ)	
R122	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R123	7030008090	S.RESISTOR	ERJ3EKF 1503 V (150 kΩ)	
R124	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)	
R125	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	
R126	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)	
R127	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R128	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R129	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R130	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	
R131	7030003530	S.RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)	
R132	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R133	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	
R134	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	
R136	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R137	7030005270	S.RESISTOR	ERJ3GEYJ 204 V (200 kΩ)	
R138	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R139	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R140	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	Ⓑ only
R141	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R142	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R143	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R146	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R147	7410000950	S.ARRAY	EXB-V8V 102JV	
R148	7410000950	S.ARRAY	EXB-V8V 102JV	
R149	7410000950	S.ARRAY	EXB-V8V 102JV	
R151	7510001280	S.THERMISTOR	NTCCM20124AG473J-T	
R152	7030003940	S.RESISTOR	ERJ3GEYF 104 V (100 kΩ)	
R153	7030003940	S.RESISTOR	ERJ3GEYF 104 V (100 kΩ)	

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
R154	7030003940	S.RESISTOR	ERJ3GEYF 104 V (100 kΩ)	
R155	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	
R156	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)	
R157	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	
R158	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	
R159	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)	
R160	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R161	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R163	7410000950	S.ARRAY	EXB-V8V 102JV	
R164	7410000950	S.ARRAY	EXB-V8V 102JV	
R165	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R166	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R167	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R168	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R169	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R170	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	
R171	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R172	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	
R173	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R174	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)	
R175	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)	
R176	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R177	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R178	7030003650	S.RESISTOR	ERJ3GEYJ 563 V (56 kΩ)	
R179	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)	
R180	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	
R181	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R182	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R183	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R184	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R185	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	
R187	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R188	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R189	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R190	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R191	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R192	7030003590	S.RESISTOR	ERJ3GEYJ 183 V (18 kΩ)	
R193	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R194	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R195	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	
R196	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R197	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R198	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R199	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R200	7410000770	S.ARRAY	EXB-V4V 102JV (1 kΩ)	
R201	7410000950	S.ARRAY	EXB-V8V 102JV	
R202	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R203	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)	
R204	7030003750	S.RESISTOR	ERJ3GEYJ 394 V (390 kΩ)	
R205	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)	
R206	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)	
R207	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)	
R208	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R209	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R210	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	
R211	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R212	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)	
R213	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
R214	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R215	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R216	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R217	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)	
R218	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R219	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)	
R220	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	
R221	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R222	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R223	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R224	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R225	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R226	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)	
R227	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)	Ⓐ only
R228	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	Ⓐ only
R229	7030003530	S.RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)	Ⓐ only
R230	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)	
R232	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)	
R233	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R234	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R238	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R239	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)	
R240	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	

Ⓐ: [F12] and [F12S]　　Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11]and [F12]　　Ⓓ: [F11BR], [F11S] and [F12S]

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
R241	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R242	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)	
R243	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)	
R244	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)	
R245	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)	Ⓑ
	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)	Ⓐ
R246	7030003240	S.RESISTOR	ERJ3GEYJ 220 V (22 Ω)	
R247	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)	
R248	7030004050	S.RESISTOR	ERJ3GEYJ 1R0 V (1 Ω)	
R249	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R250	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)	
R251	7030003690	S.RESISTOR	ERJ3GEYJ 124 V (120 kΩ)	
R252	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)	
R253	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)	
C1	4030007000	S.CERAMIC	C1608 CH 1H 090D-T-A	
C2	4030006980	S.CERAMIC	C1608 CH 1H 070D-T-A	
C3	4030009650	S.CERAMIC	C1608 CH 1H 240J-T-A	
C4	4030011530	S.CERAMIC	C1608 CH 1H 110J-T-A	
C5	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A	
C6	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C7	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C8	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C9	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C10	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	
C11	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A	
C12	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C13	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A	
C14	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A	
C15	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C17	4030007110	S.CERAMIC	C1608 CH 1H 680J-T-A	
C18	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C20	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C21	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C23	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C24	4030017430	S.CERAMIC	ECJ0EC1H101J	
C25	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C26	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C27	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C33	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A	
C34	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C35	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C36	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	
C37	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C38	4030007000	S.CERAMIC	C1608 CH 1H 090D-T-A	
C39	4030007020	S.CERAMIC	C1608 CH 1H 120J-T-A	
C40	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C41	4030006980	S.CERAMIC	C1608 CH 1H 070D-T-A	
C42	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A	
C43	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C44	4030009520	S.CERAMIC	C1608 CH 1H 020B-T-A	
C45	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C46	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C48	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C49	4030009500	S.CERAMIC	C1608 CH 1H 0R5B-T-A	
C51	4030009520	S.CERAMIC	C1608 CH 1H 020B-T-A	
C56	4550006450	S.TANTALUM	ECST1EY105R	
C57	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C58	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	
C59	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C60	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C61	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C62	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C63	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C64	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C65	4030009520	S.CERAMIC	C1608 CH 1H 020B-T-A	
C66	4030008750	S.CERAMIC	C1608 CH 1H 360J-T-A	
C67	4030006870	S.CERAMIC	C1608 JB 1H 222K-T-A	
C69	4030007120	S.CERAMIC	C1608 CH 1H 820J-T-A	
C70	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C71	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C72	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C73	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C75	4550006450	S.TANTALUM	ECST1EY105R	
C76	4550006600	S.TANTALUM	ECST0JY335R	
C78	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C80	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C81	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A	
C82	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C83	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A	

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
C84	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C85	4510005860	S.ELECTROLYTIC	ECEV1HA2R2SR	
C86	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C87	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C88	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C89	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C90	4030007100	S.CERAMIC	C1608 CH 1H 560J-T-A	
C91	4030007100	S.CERAMIC	C1608 CH 1H 560J-T-A	
C92	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C93	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C94	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C95	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C96	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C97	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C98	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C99	4030011530	S.CERAMIC	C1608 CH 1H 110J-T-A	
C100	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	Ⓐ
	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A	Ⓑ
C101	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A	Ⓐ
	4030009910	S.CERAMIC	C1608 CH 1H 040B-T-A	Ⓑ
C102	4030009910	S.CERAMIC	C1608 CH 1H 040B-T-A	Ⓐ
	4030011770	S.CERAMIC	C1608 CH 1H 060B-T-A	Ⓑ
C103	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C104	4030007060	S.CERAMIC	C1608 CH 1H 270J-T-A	Ⓑ
	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	Ⓐ
C105	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A	Ⓐ
	4030009550	S.CERAMIC	C1608 CH 1H 2R5B-T-A	Ⓑ
C106	4030009510	S.CERAMIC	C1608 CH 1H 010B-T-A	
C107	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C108	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C109	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C110	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C111	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A	Ⓐ
	4030009910	S.CERAMIC	C1608 CH 1H 040B-T-A	Ⓑ
C112	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C113	4030007100	S.CERAMIC	C1608 CH 1H 560J-T-A	
C114	4030017460	S.CERAMIC	ECJ0EB1E102K	
C115	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C116	4030009550	S.CERAMIC	C1608 CH 1H 2R5B-T-A	
C117	4030007120	S.CERAMIC	C1608 CH 1H 820J-T-A	
C118	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C119	4030009540	S.CERAMIC	C1608 CH 1H 1R5B-T-A	
C120	4030007070	S.CERAMIC	C1608 CH 1H 330J-T-A	Ⓑ
	4030007110	S.CERAMIC	C1608 CH 1H 680J-T-A	Ⓐ
C121	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C122	4030009350	S.CERAMIC	C1608 CH 1H 3R5B-T-A	Ⓐ
	4030011770	S.CERAMIC	C1608 CH 1H 060B-T-A	Ⓑ
C123	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	
C124	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C125	4030007060	S.CERAMIC	C1608 CH 1H 270J-T-A	
C126	4030007070	S.CERAMIC	C1608 CH 1H 330J-T-A	
C127	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C128	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C129	4030007100	S.CERAMIC	C1608 CH 1H 560J-T-A	
C130	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C132	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C133	4030009510	S.CERAMIC	C1608 CH 1H 010B-T-A	
C134	4030007000	S.CERAMIC	C1608 CH 1H 090D-T-A	
C136	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C137	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A	
C138	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C139	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C140	4030007140	S.CERAMIC	C1608 CH 1H 121J-T-A	
C142	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C143	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C144	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C145	4030008680	S.CERAMIC	C2012 JF 1C 105Z-T-A	
C146	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C147	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C148	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A	
C149	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	
C150	4030009520	S.CERAMIC	C1608 CH 1H 020B-T-A	
C151	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A	
C152	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A	
C153	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C154	4030007170	S.CERAMIC	C1608 CH 1H 221J-T-A	
C155	4030007170	S.CERAMIC	C1608 CH 1H 221J-T-A	
C156	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C157	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
C158	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C159	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C160	4510004640	S.ELECTROLYTIC	ECEV1CA470SP	
C161	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C162	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A	
C163	4510006940	S.ELECTROLYTIC	EEVFC0J101P	
C164	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A	
C165	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C166	4550006700	S.TANTALUM	ECST1AY106R	
C167	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A	
C168	4030009660	S.CERAMIC	C1608 JF 1C 224Z-T-A	
C169	4550006650	S.TANTALUM	ECST1CY685R	
C170	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C171	4030009660	S.CERAMIC	C1608 JF 1C 224Z-T-A	
C172	4510006090	S.ELECTROLYTIC	ECEV0GA470SR	
C173	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C174	4030007150	S.CERAMIC	C1608 CH 1H 151J-T-A	
C175	4030008770	S.CERAMIC	C1608 JB 1H 562K-T-A	
C176	4030009970	S.CERAMIC	C1608 JB 1H 182K-T-A	
C177	4550006170	S.TANTALUM	ECST1AY225R	
C178	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C179	4030008680	S.CERAMIC	C2012 JF 1C 105Z-T-A	
C181	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A	
C182	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A	
C183	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C184	4030007160	S.CERAMIC	C1608 CH 1H 181J-T-A	
C185	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C186	4030008770	S.CERAMIC	C1608 JB 1H 562K-T-A	Ⓑ
	4030006870	S.CERAMIC	C1608 JB 1H 222K-T-A	Ⓐ
C187	4030008880	S.CERAMIC	C1608 JB 1C 223K-T-A	Ⓑ only
C188	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	
C189	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A	
C190	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A	
C191	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C192	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C193	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A	
C194	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A	
C195	4030007110	S.CERAMIC	C1608 CH 1H 680J-T-A	
C196	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A	
C197	4510005430	S.ELECTROLYTIC	ECEV0JA220SR	
C198	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C199	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C200	4030008890	S.CERAMIC	C1608 JB 1C 273K-T-A	
C201	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C202	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C203	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C204	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C205	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C206	4550006200	S.TANTALUM	ECST0JY106R	
C207	4510004630	S.ELECTROLYTIC	ECEV1CA100SR	
C208	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C209	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A	
C210	4510005430	S.ELECTROLYTIC	ECEV0JA220SR	
C211	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C212	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C213	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C214	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C215	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C216	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C217	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C218	4030008910	S.CERAMIC	C1608 JB 1C 393K-T-A	
C219	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C220	4030009490	S.CERAMIC	C1608 JB 1H 821K-T-A	
C221	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C222	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C223	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C224	4030008900	S.CERAMIC	C1608 JB 1C 333K-T-A	
C225	4510004650	S.ELECTROLYTIC	ECEV1EA4R7SR	
C226	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C227	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C228	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C229	4030009880	S.CERAMIC	C1608 JB 1H 682K-T-A	
C230	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C231	4030008910	S.CERAMIC	C1608 JB 1C 393K-T-A	
C232	4030010020	S.CERAMIC	C1608 JB 1H 122K-T-A	
C233	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C234	4030009490	S.CERAMIC	C1608 JB 1H 821K-T-A	
C235	4030009490	S.CERAMIC	C1608 JB 1H 821K-T-A	
C236	4030008880	S.CERAMIC	C1608 JB 1C 223K-T-A	
C237	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C238	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	

Ⓐ: [F12] and [F12S]　　Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11]and [F12]　　Ⓓ: [F11BR], [F11S] and [F12S]

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION		
C239	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C240	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C242	4030008470	S.CERAMIC	C1608 JB 1H 272K-T-A	
C243	4030008770	S.CERAMIC	C1608 JB 1H 562K-T-A	
C244	4030007160	S.CERAMIC	C1608 CH 1H 181J-T-A	
C245	4030009630	S.CERAMIC	C1608 JB 1H 822K-T-A	
C246	4030007110	S.CERAMIC	C1608 CH 1H 680J-T-A	
C247	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C248	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C249	4030017480	S.CRAMIC	C1608 JB 1A 474K-T-N	Ⓐ only
C252	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A	
C253	4030007000	S.CERAMIC	C1608 CH 1H 090D-T-A	
C255	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A	
C257	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C258	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A	
C259	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A	
C260	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C261	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C262	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N	
C265	4030006980	S.CERAMIC	C1608 CH 1H 070D-T-A	
C266	4550000530	S.TANTALUM	TESVA 1V 104M1-8L	
C267	4030011770	S.CERAMIC	C1608 CH 1H 060B-T-A	
C268	4030009550	S.CERAMIC	C1608 CH 1H 2R5B-T-A	
C269	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
C270	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A	
J1	6910013720	CONNECTOR	IMSA-9230B-04Z120-T	Ⓒ only
J2	6910013730	CONNECTOR	IMSA-9230B-07Z120-T	
J3	6510021900	S.CONNECTOR	BM02B-ASRS-TF	
J4	6450001680	CONNECTOR	HSJ1122-010010	
J5	6450001690	CONNECTOR	HSJ1456-01-220	
MC1	7700002540	MICROPHON	SKP-4538	
S1	2230001060	S.SWITCH	EVQ-PUL 02K	
S2	2230001060	S.SWITCH	EVQ-PUL 02K	
S3	2230001060	S.SWITCH	EVQ-PUL 02K	
W8	7030003860	S.JUMPER	ERJ3GE JPW V	
W11	7030003860	S.JUMPER	ERJ3GE JPW V	Ⓓ only
W12	7030003860	S.JUMPER	ERJ3GE JPW V	Ⓓ only
W13	7030003860	S.JUMPER	ERJ3GE JPW V	Ⓓ only
EP1	0910054482	PCB	B 5680B	
EP4	6910013370	S.BEAD	BLM11B221SB	
EP5	6910013370	S.BEAD	BLM11B221SB	
EP6	6910013370	S.BEAD	BLM11B221SB	
EP7	6910013370	S.BEAD	BLM11B221SB	Ⓐ only

Ⓐ: [F12] and [F12S]
Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11]and [F12]
Ⓓ: [F11BR], [F11S] and [F12S]

S.=Surface mount

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

[CHASSIS PARTS]

REF. NO.	ODER NO.	DESCRIPTION		QTY.
SP1	2510001100	Speaker 036D0601		1
MP1	8210017710	2458 front panel		1
MP4	8930054680	2458 release button		1
MP6	8930054690	2458 lens		1
MP7	8210017730	2458 jack panel		1
MP8	8930054881	2458 plus terminal-1		1
MP9	8010018501	2458 chassis-1		1
MP10	8930054710	2458 A-main seal	Ⓐ	1
	8930054720	2458 B-main seal	Ⓑ	1
MP11	8930042350	1922 mic sheet		1
MP12	8930050840	2251 minus terminal		1
MP13	8830001550	Nut (J)		1
MP14	8830001570	Nut (K)	Ⓑ	1
	8830001550	Nut (J)	Ⓐ	1
MP15	8950005320	2337 contact		1
MP18	8610010910	Knob N-281		1
MP19	8610010920	Knob N-282	Ⓐ only	1
MP20	8810004860	Screw PH M 2 x 6 ZK		2
MP21	8810000100	Screw PH M 2 x 4 ZK		2
MP22	8810009560	Screw B0 M 2 x 6 ZK		2
MP26	8930053680	Spring (AG)		1
MP27	8210017090	2337 terminal holder		1
MP28	8930052840	2337 T-rubber		1
MP29	8810009510	B0 M02 x 4 NI-ZU (BT)		10
MP30	8930043760	1923 Mic seal		1
MP32	8950004671	ANT connector 101A		1
MP33	8830001250	ANT connector 101 nut		1
MP34	8930055110	2458 side plate		1
MP35	8810009510	Screw B0 M 2 x 4 NI-ZU (BT)	Ⓑ only	1
MP39	8810009180	Screw B0 M 2 x 5 NI-ZU (BT)		1

Ⓐ: [F11], [F12] Ⓑ: [F11BR], [F11S], [F12S]
Ⓒ: [F11BR], [F11S]*1

*1: For [USA] only.

Screw abbreviations
B0, BT: Self-tapping
PH: Pan head
NI: Nickel
ZK: Black
NI-ZU: Nickel-zinc

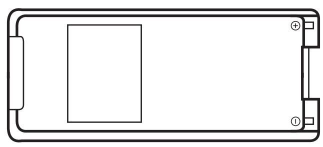
[MAIN UNIT]

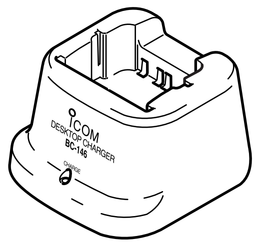
REF. NO.	ODER NO.	DESCRIPTION	QTY.
MP1	8510013000	2336 VCO case	1
MP2	8510011101	1922 VCO cover-1	1
MP6	8510013800	2458 main shield	1

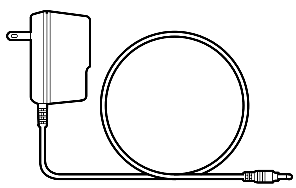
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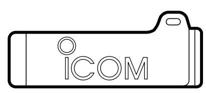
REF. NO.	ODER NO.	DESCRIPTION		QTY.
EP1	Optional product	Antenna FA-SC55U		1
EP2	Optional product	Battery BP-222	[F11BR]	1
	Optional product	Battery BP-209	[OTHER]	1
EP4	Optional product	BC-147A	Ⓒ only	1
EP5	Optional product	BC-146 ACC	Ⓒ only	1
MP1	Optional product	1922 Belt clip		1

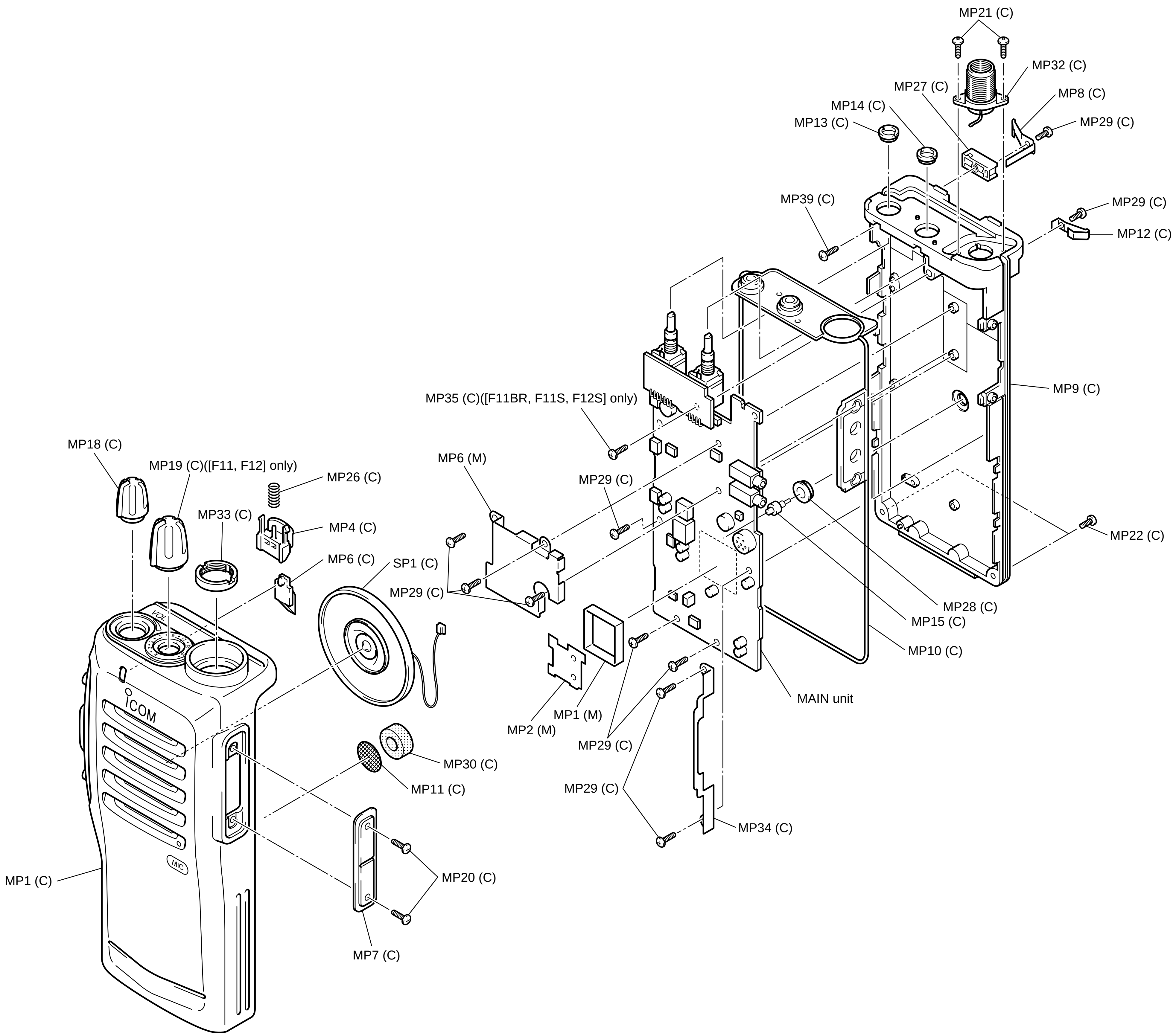
EP1


EP2


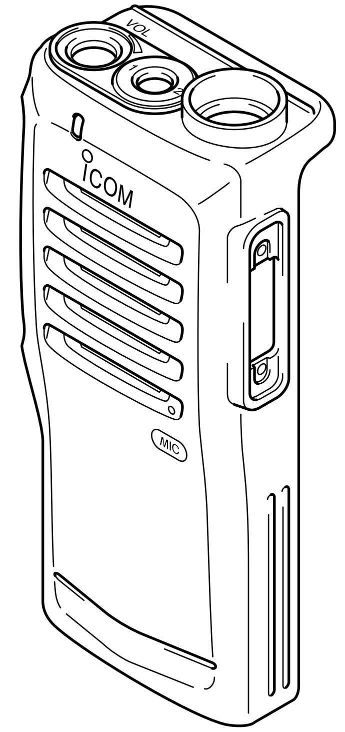
EP4


EP5


MP1




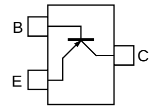
IC-F11BR, F11S, F12S

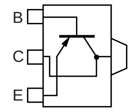


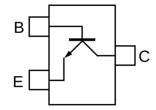
UNIT abbreviation (C): CHASSIS PARTS, (M): MAIN UNIT

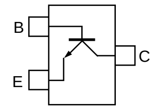
SECTION 8 SEMI-CONDUCTOR INFORMATION

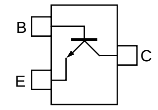
• TRANSISTOR AND FET'S

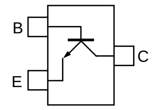
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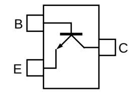
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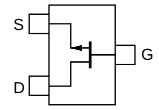
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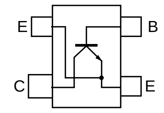
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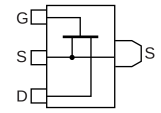
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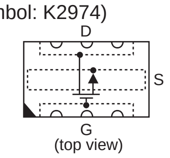
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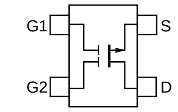
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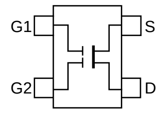
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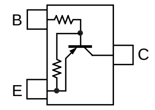
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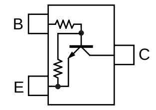
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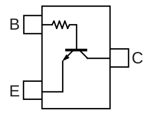
2SK2974
(Symbol: K2974)


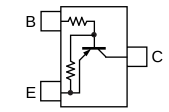
3SK272
(Symbol: K)


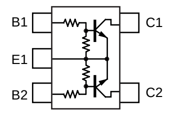
3SK294
(Symbol: UV)


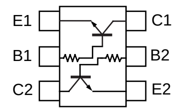
DTA144 EU
(Symbol: 16)


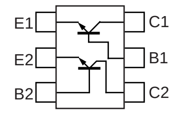
DTC144 EU
(Symbol: 26)


DTC144 TU
(Symbol: 06)


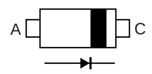
UN911 H
(Symbol: 6P)


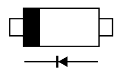
XP1213
(Symbol: 9L)


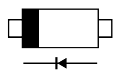
XP4216 TX
(Symbol: 8U)


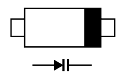
XP6501 AB
(Symbol: 5N)


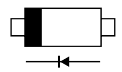
• DIODES

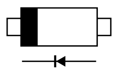
1SV307
(Symbol: TX)


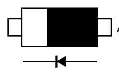
HSU88 TRF
(Symbol: 9)


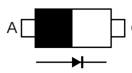
HVC362
(Symbol: V2)


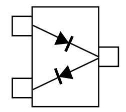
HVU350 B
(Symbol: 4)


MA2S077
(Symbol: S)


MA2S111
(Symbol: A)


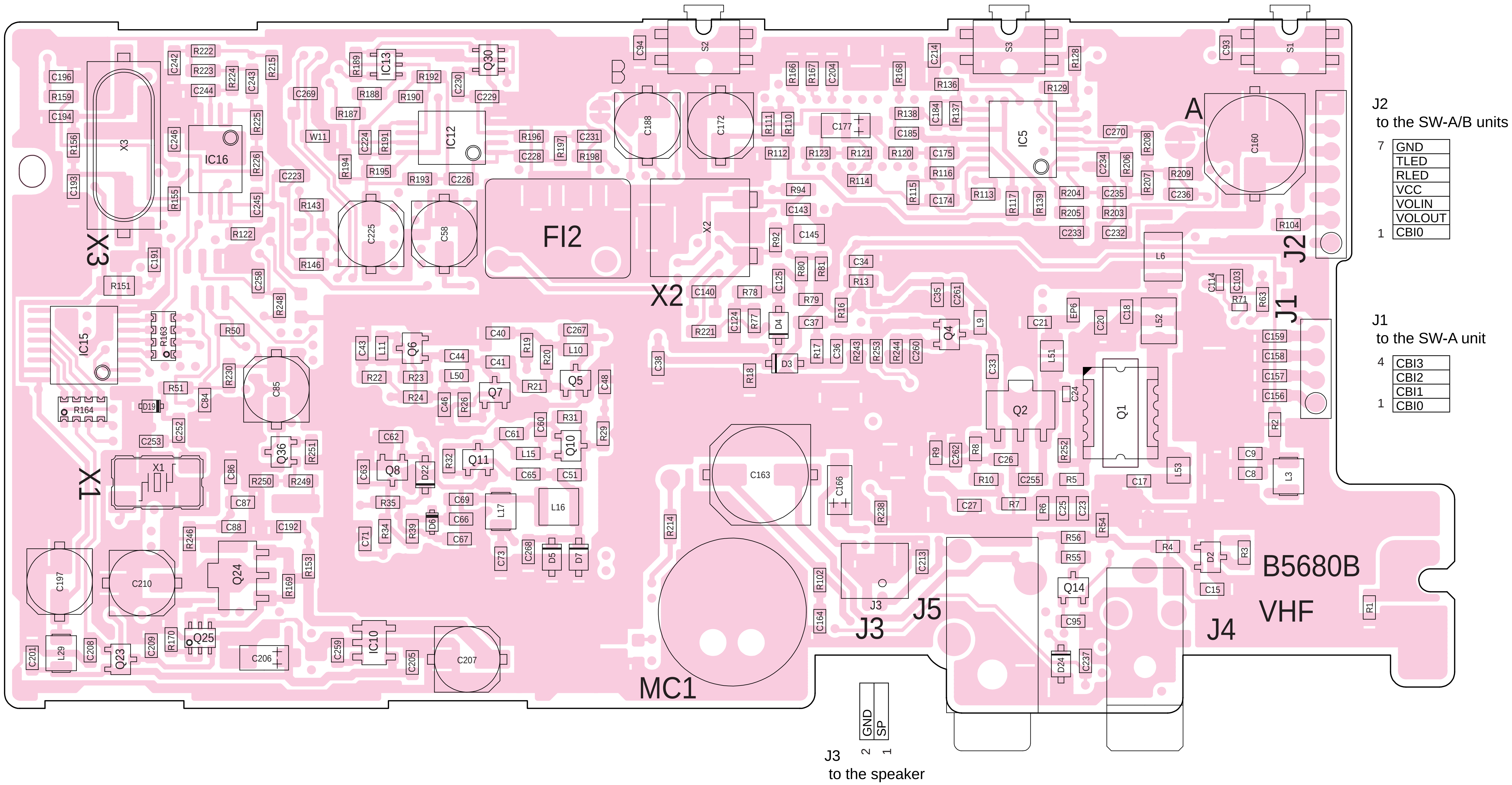
MA368
(Symbol: 6L)


MA77
(Symbol: 4B)


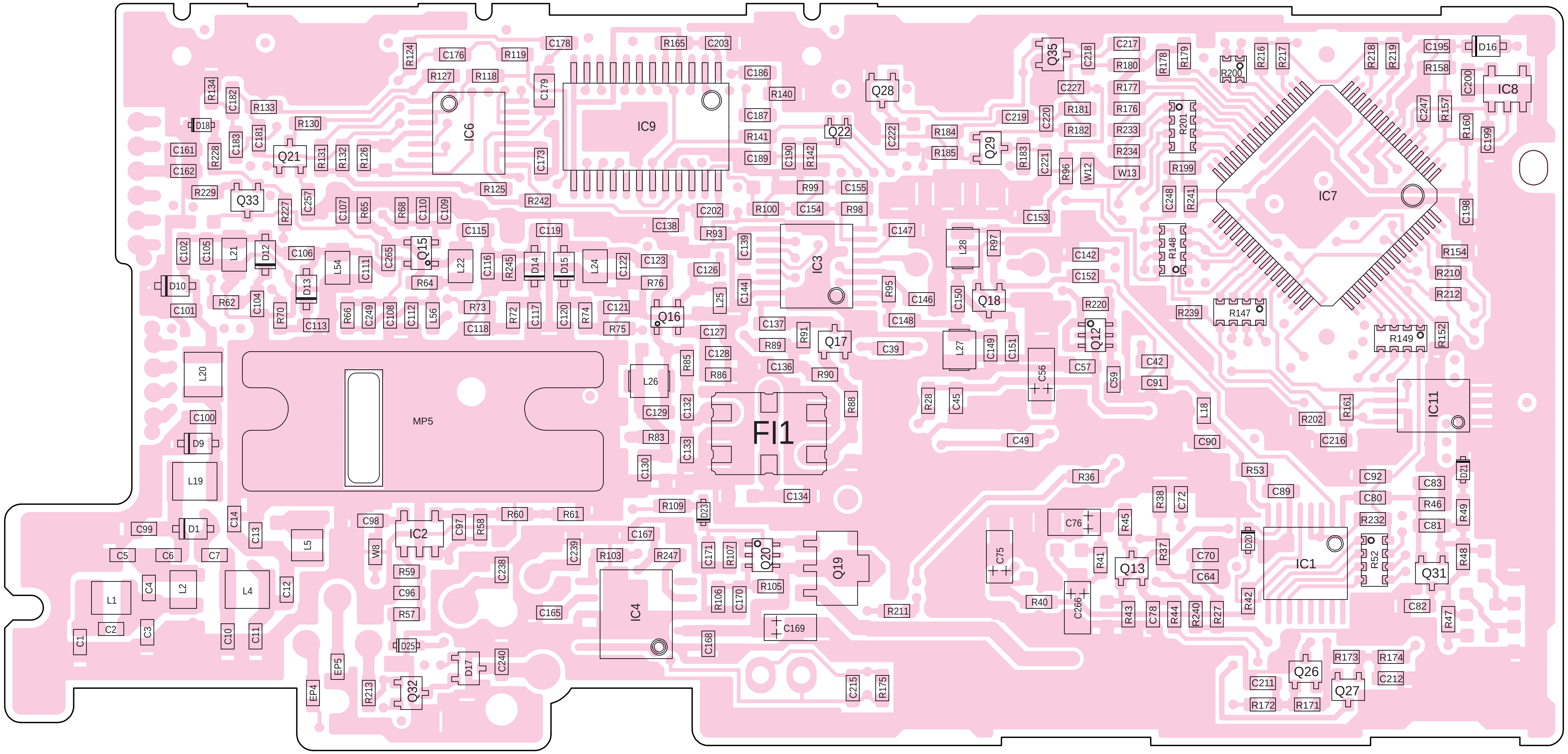
RB706F-40
(Symbol: 3J)


9-1 MAIN UNIT

• TOP VIEW

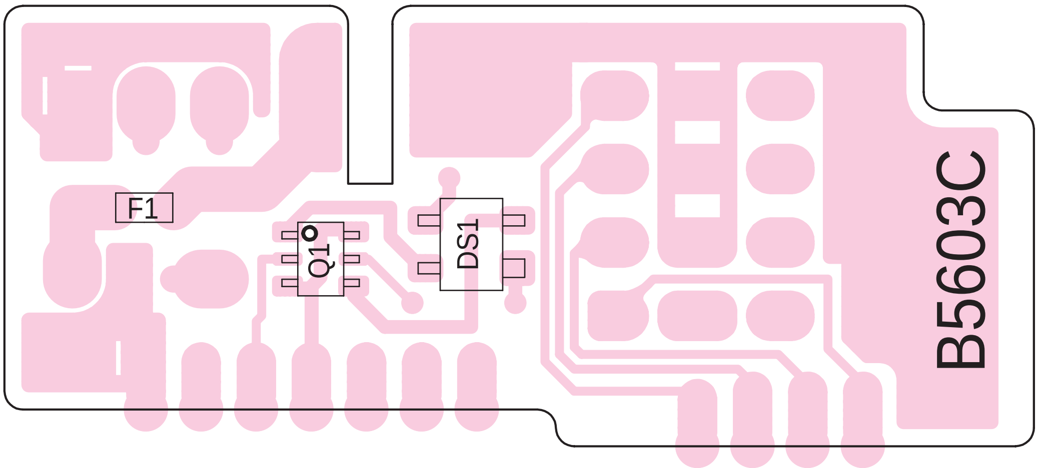


• **BOTTOM VIEW**

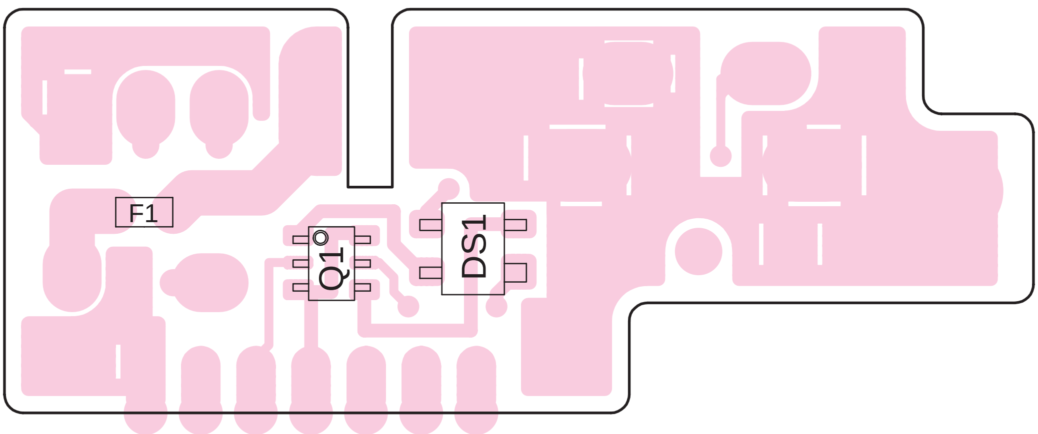


9-2 SW-A AND SW-B UNITS

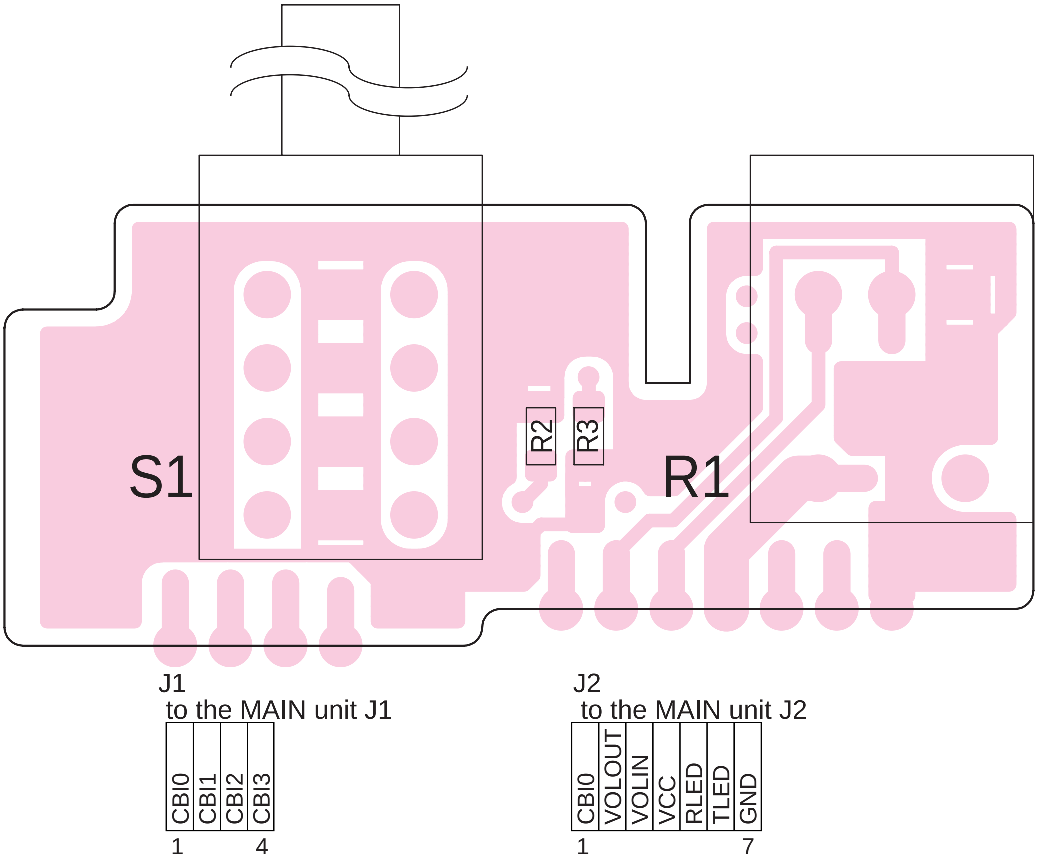
• **TOP VIEW**
SW-A UNIT



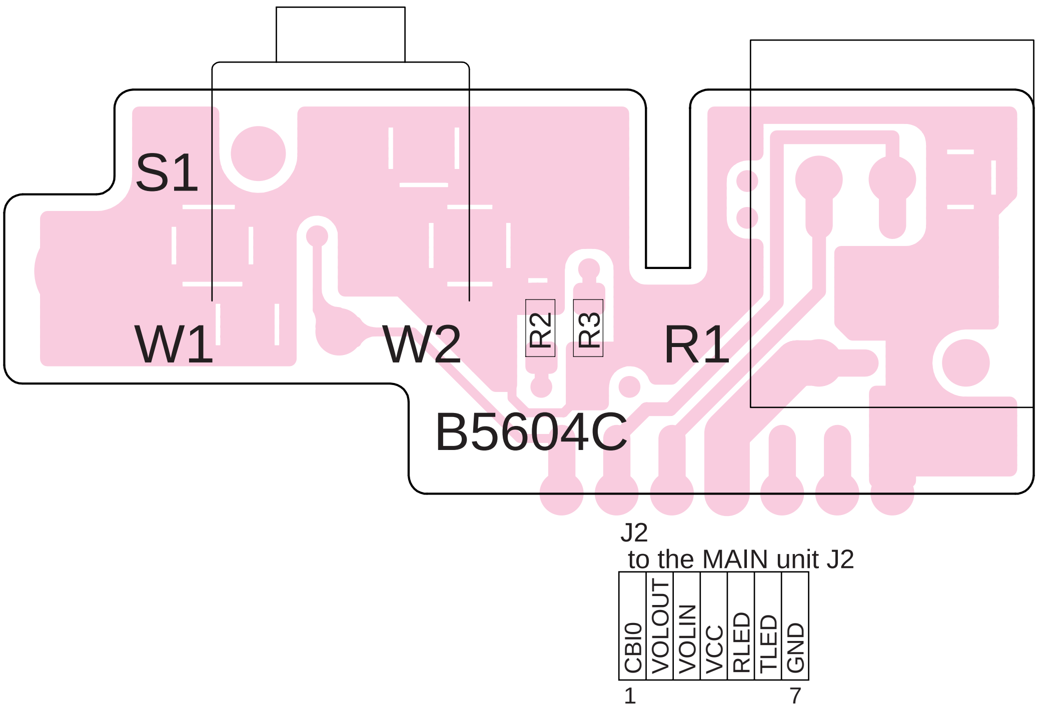
SW-B UNIT



• **BOTTOM VIEW**
SW-A UNIT



SW-B UNIT



SECTION 10 BC-146 OPTIONAL DESKTOP CHARGER INFORMATION

10-1 PARTS LIST

[CHARGE UNIT]

REF. NO.	ODER NO.	DESCRIPTION		QTY.
R1	7010007550	RESISTOR	ERG3SJ680H	1
R2	7010007100	RESISTOR	PSD1/4V 1 kΩ	1
J1	6510021470	CONNECTOR	HEC0470-01-230	1
DS1	5040001390	LED	TLG124A	1
EP1	0910053820	PCB	B 5650	1
MP1	8930051340	2338 TERMINAL		1
MP2	8930051340	2338 TERMINAL		1

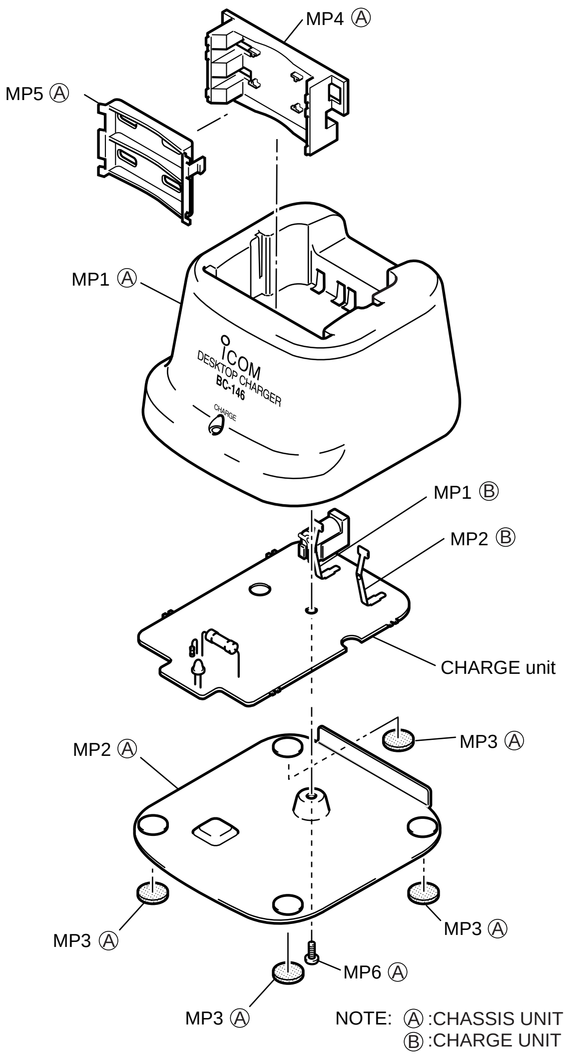
[CHASSIS UNIT]

REF. NO.	ODER NO.	DESCRIPTION	QTY.
MP1	8010018620	2447 case (A)	1
MP2	8110007450	2447 cover	1
MP3	8930039620	Leg cushion (A)	4
MP4	8930055020	2480 spacer	1
MP5	8930055030	2480 BC-spacer	1
MP6	8810008660	Screw B0 M 3 x 8 NI-ZU (BT)	1

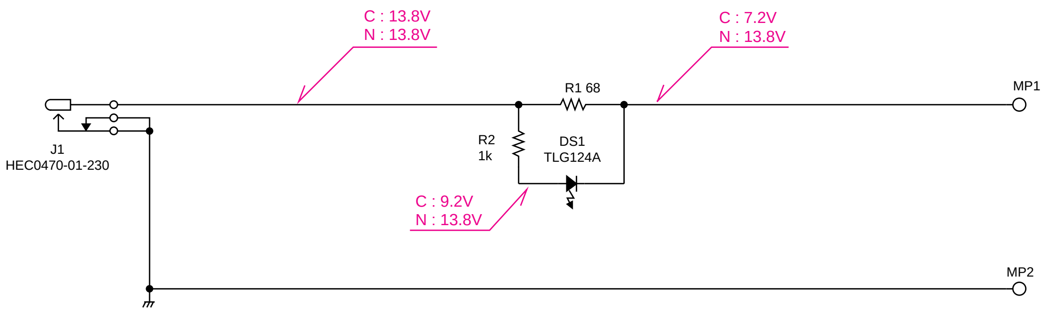
Screw abbreviations B0, BT:Self-tapping
NI-ZU :Nickel-Zinc

NOTE: BC-146 is included with IC-F11BR and IC-F11S (For USA).

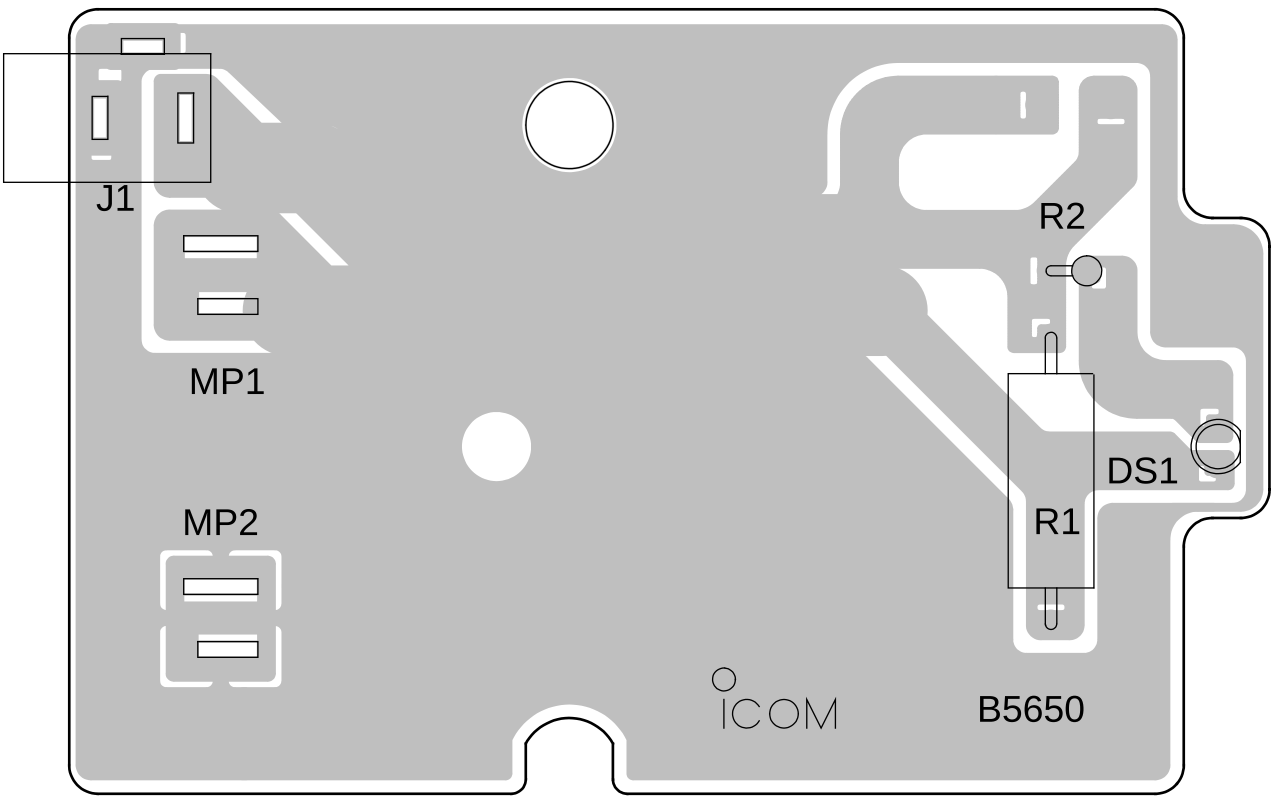
10-2 DISASSEMBLY INFORMATION



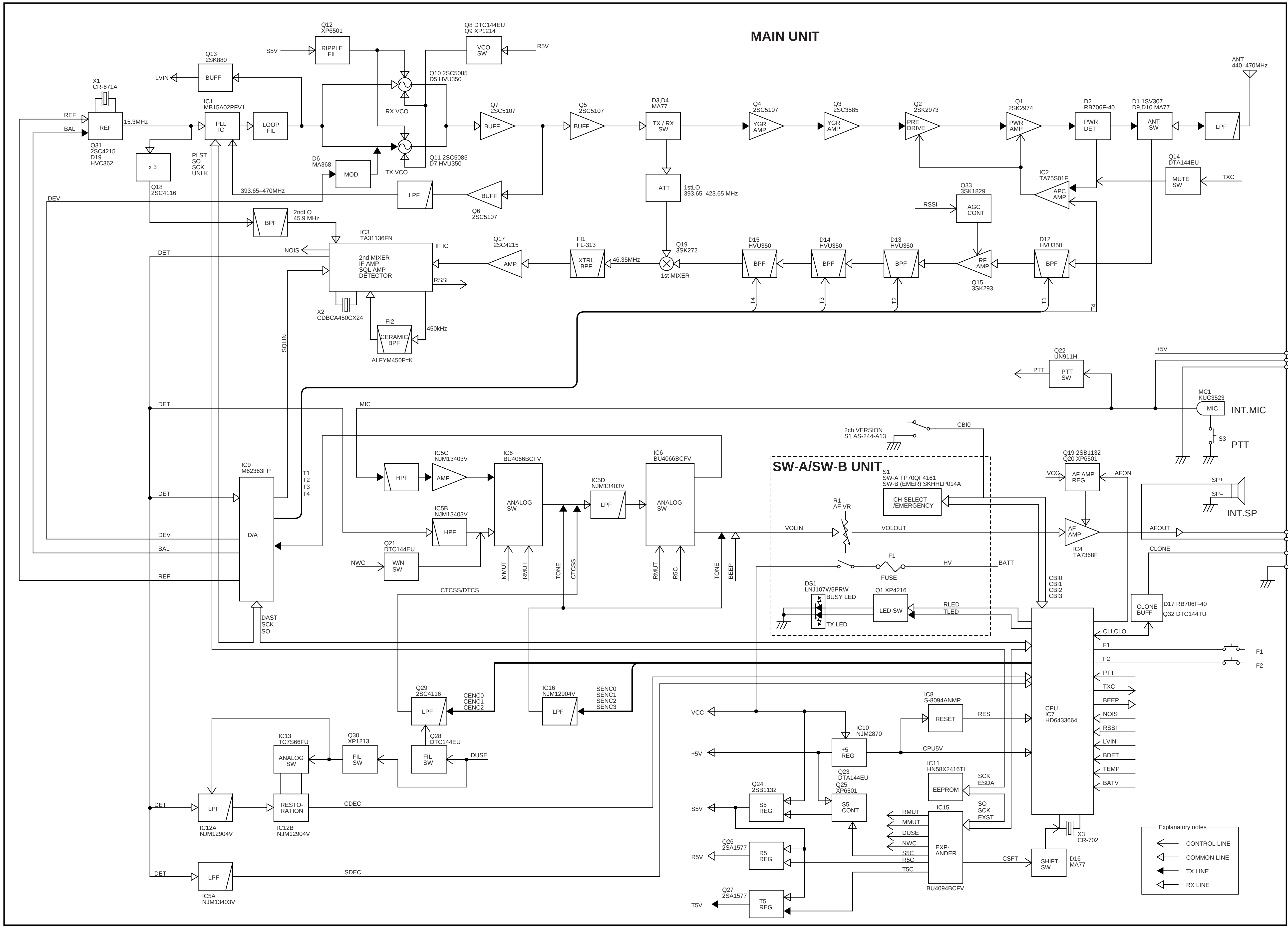
10-3 VOLTAGE DIAGRAM



10-4 BOARD LAYOUT

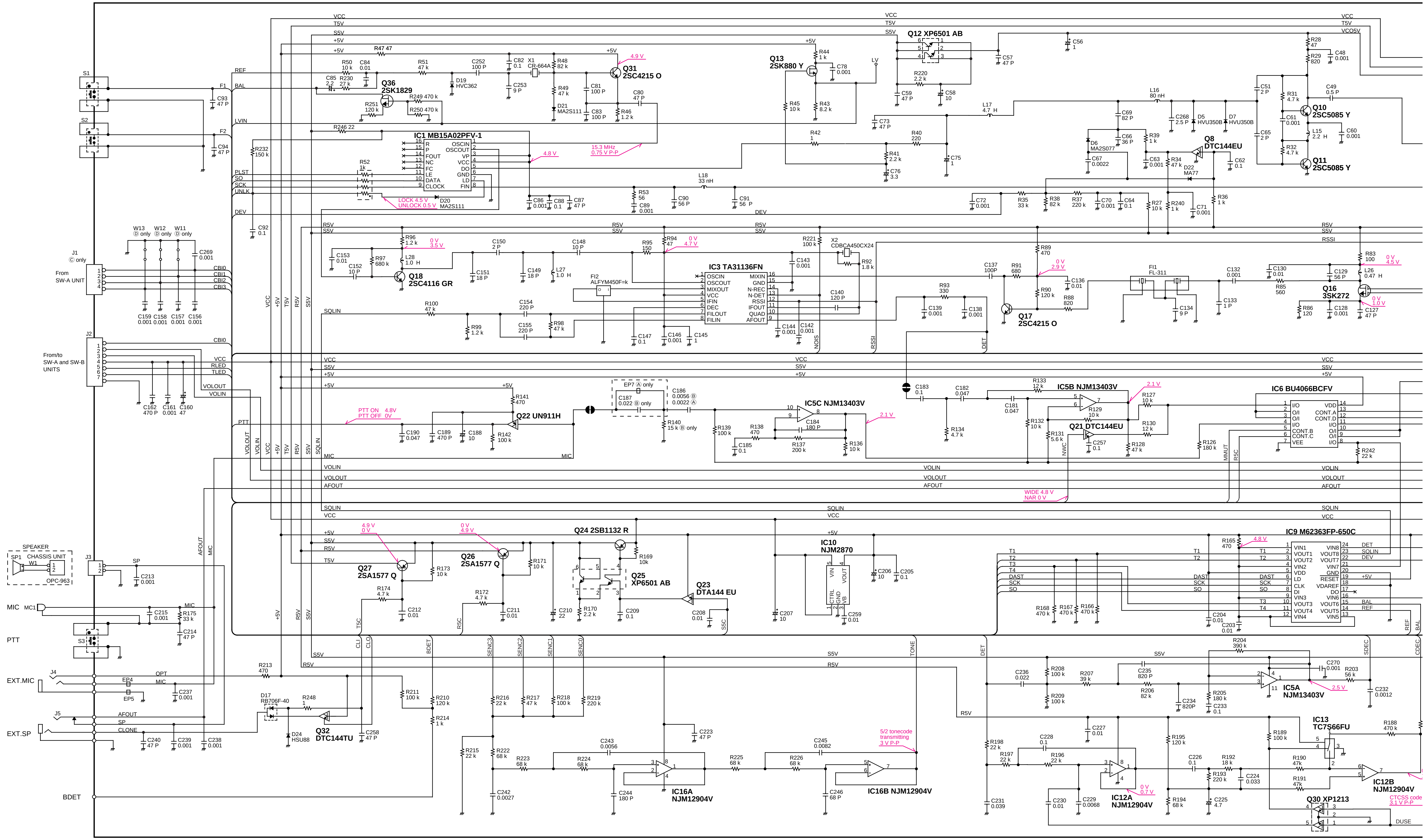


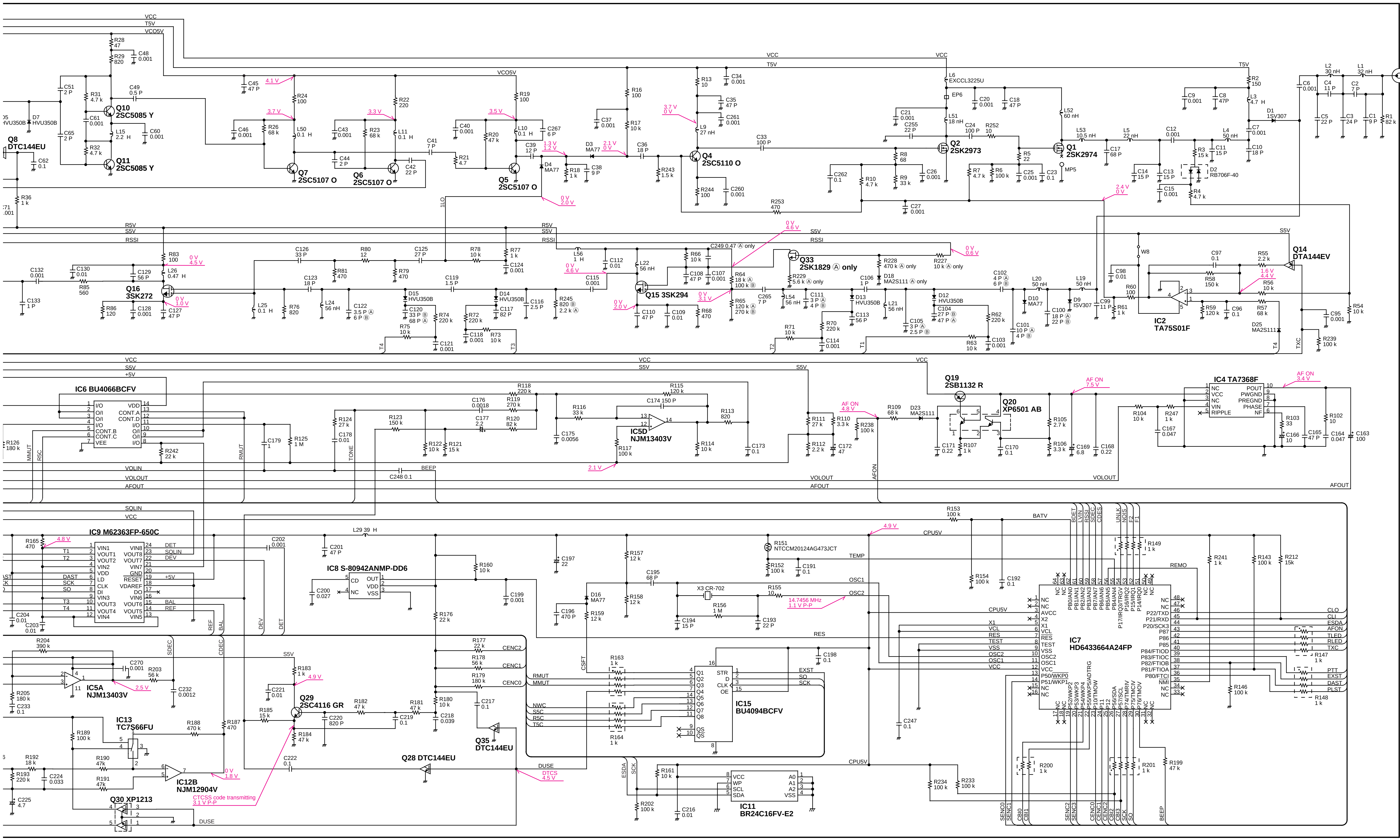
SECTION 11 BLOCK DIAGRAM



SECTION 12 VOLTAGE DIAGRAM


NOTE: Ⓐ: [F12] and [F12S] Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11] and [F12] Ⓓ: [F11BR], [F11S] and [F12S]




IC2 TA75S01F
IC4 TA7368F
IC5A NJM13403V
IC5D NJM13403V
IC6 BU4066BCFV
IC7 HD6433664A24FP
IC8 S-80942ANMP-DD6
IC9 M62363FP-650C
IC11 BR24C16FV-E2
IC12B NJM12904V
IC13 TC7S66FU
IC15 BU4094BCFV
Q1 2SK2974
Q2 2SK2973
Q4 2SC5110 O
Q5 2SC5107 O
Q6 2SC5107 O
Q7 2SC5107 O
Q8 DTC144EU
Q10 2SC5085 Y
Q11 2SC5085 Y
Q14 DTA144EV
Q15 3SK294
Q16 3SK272
Q19 2SB1132 R
Q20 XP6501 AB
Q28 DTC144EU
Q29 2SC4116 GR
Q30 XP1213
Q33 2SK1829 Ⓐ only
Q35 DTC144EU
ANT
CTCSS code transmitting 3.1 V P-P
14.7456 MHz 1.1 V P-P

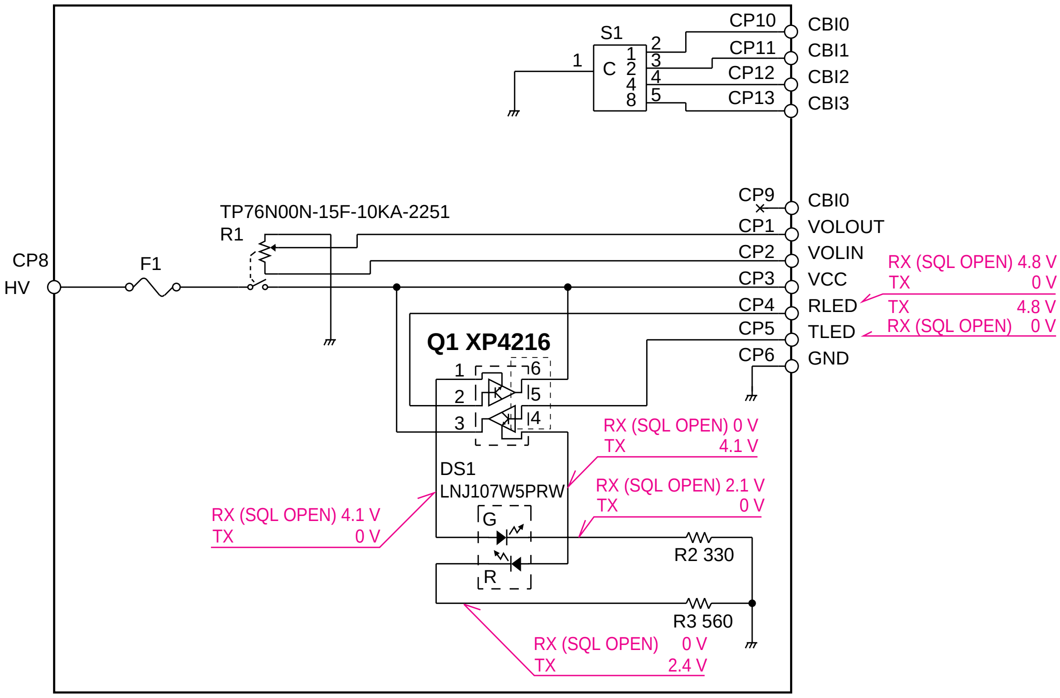
SECTION 12 VOLTAGE DIAGRAM

NOTE: Ⓐ: [F12] and [F12S] Ⓑ: [F11], [F11BR] and [F11S]
Ⓒ: [F11] and [F12] Ⓓ: [F11BR], [F11S] and [F12S]

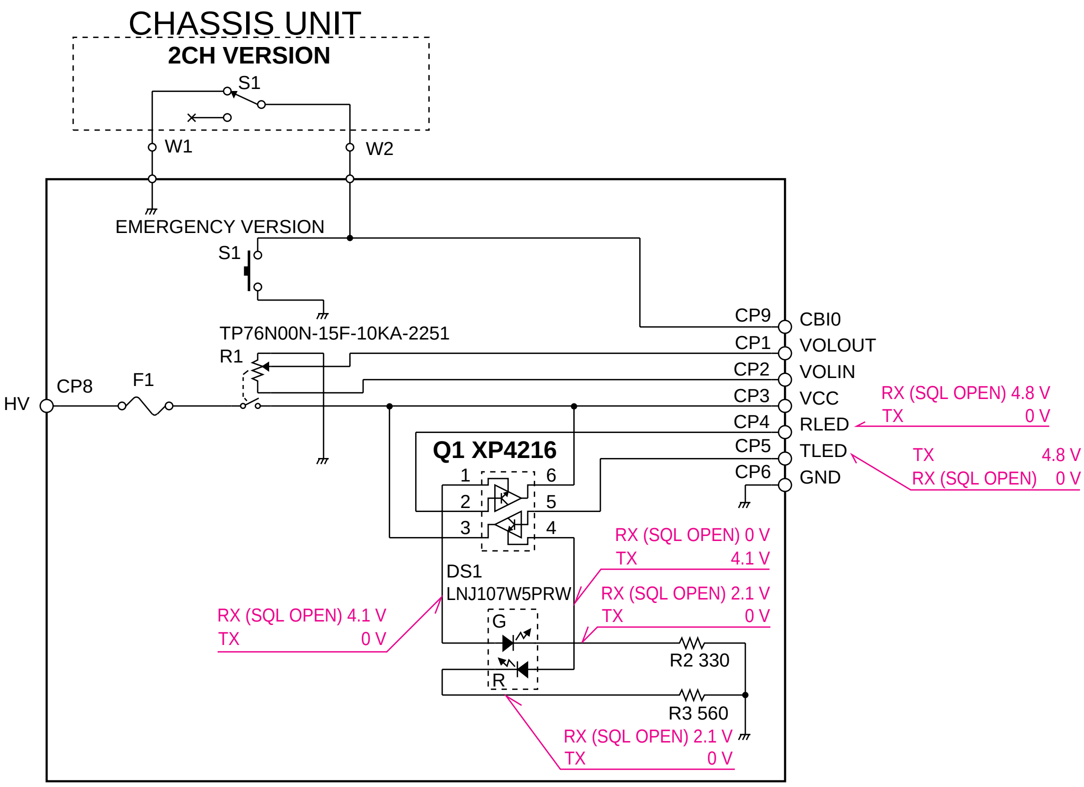


12-2 SW-A AND SW-B UNITS

• **SW-A UNIT**



• **SW-B UNIT**



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